LIFECARE PCA™

with

Hospira MedNet™

For use with list numbers 20709

Technical Service Manual

Hospira, Inc.
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Hospira

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Change History

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Section 1

INTRODUCTION

The LifeCare PCA™ with Hospira MedNet™ Software is a patient-controlled analgesia management system designed to meet the fluid delivery requirements of today's evolving healthcare environments. The system is comprised of a pole mounted or tabletop drug infuser (LifeCare PCA), barcoded drug vials with a variety of pre-filled drugs and drug concentrations (PCA vial), and a compatible administration set.

The LifeCare PCA is a self-contained, microprocessor-based infusion device that features keypad controls, a prompting alphanumeric display, an LED display, an integral locking system, a pole clamp, a barcode reader designed to automate drug identification, and field-upgradeable software.

The device contains a Communication Engine (CE) that provides wired Ethernet communication and wireless communication via WiFi protocol 802.11 a/b/g.

Hospira MedNet networked application software allows a facility to customize and download a Drug Library for use with the infusion system. Before using the software, see the ***Hospira MedNet™ Software User Guide***.

The infusion system is intended to operate on AC power. An internal battery is provided to maintain operation for short periods of time during patient transport and when AC power is lost or not available.

1.1 SCOPE

This manual is organized into the following sections:

- **Section 1 Introduction**
- **Section 2 Warranty**
- **Section 3 System Operating Manual**
- **Section 4 Theory of Operation**
- **Section 5 Maintenance and Service Tests**
- **Section 6 Troubleshooting**
- **Section 7 Replaceable Parts and Repairs**
- **Section 8 Specifications**
- **Section 9 Drawings**
- **Appendices**
- **Index**
- **Technical Service Bulletins**

If a problem in device operation cannot be resolved using the information in this manual, **contact Hospira *(see Section 6.1)***.

Specific instructions for operating the device are contained in its respective ***System Operating Manual***.

The terms “infusion system”, “infuser”, and “device” are used interchangeably throughout the manual.

Figures are rendered as graphic representations to approximate actual product. Therefore, figures may not exactly reflect the product. Screen representations are examples only, and do not necessarily reflect the most current configuration

1.2
CONVENTIONS

The conventions listed in ***Table 1-1*** are used throughout this manual.

Table 1-1. Conventions

Convention	Application	Example
Italic	Reference to a section, figure, table, website, or publication	***(see Section 6.1)***
[ALL CAPS] **ALL CAPS**	In-text references to keys, touchswitches, and display messages	**[START]** **LOW BATTERY**
Bold	Emphasis	**CAUTION: Use proper ESD grounding techniques when handling components.**
	Screen displays	Select **Set Time and Date**.

Throughout this manual, warnings, cautions, and notes are used to emphasize important information, as follows:

WARNING: A WARNING CONTAINS SPECIAL SAFETY EMPHASIS AND MUST BE OBSERVED AT ALL TIMES. FAILURE TO OBSERVE A WARNING MAY RESULT IN PATIENT INJURY AND BE LIFE-THREATENING.

CAUTION: A CAUTION usually appears in front of a procedure or statement. It contains information that could prevent hardware failure, irreversible damage to equipment, or loss of data.

Note: A note highlights information that helps explain a concept or procedure.

✓EN-2 Information applies to IEC/EN 60601-1-2:2001 compliant devices.

1.3 COMPONENT DESIGNATORS

Components are indicated by alpha-numeric designators, as follows:

Battery	**BT**	Diode	**D**	Resistor	**R**
Capacitor	**C**	Fuse	**F**	Switch	**SW**
Crystal	**Y**	Integrated Circuit	**U**	Transistor	**Q**

The number following the letter is a unique value for each type of component (e.g., R1, R2).

> **Note:** Alpha-numeric designators may be followed with a dash (-) number that indicates a pin number for that component. For example, U15-13 is pin 13 of the encoder chip [U15] on the interface PWA.

1.4 ACRONYMS AND ABBREVIATIONS

Acronyms and abbreviations used in this manual are as follows:

A	Ampere
AC	Alternating current
ADC	Analog-to-digital converter
BCR	Barcode reader
CE	Connectivity engine
CMOS	Complementary metal-oxide semiconductor
CPU	Central processing unit
dB	Decibel
DC	Direct current
DPM	Digital pressure meter
DSLR	Display start line register
ECG	Electrocardiograph
EEG	Electroencephalogram
EMC	Electromagnetic compatibility
EMG	Electromyogram
EMI	Electromagnetic interference
EPROM	Erasable/programmable read-only memory
ESD	Electrostatic discharge
ETO	Ethylene oxide
hr	Hour
Hz	Hertz
ID	Identification
I/O	Input/output

IPB	Illustrated parts breakdown
IV	Intravenous
lbs	Pounds
LCD	Liquid crystal display
LED	Light emitting diode
mA	Milliampere
mcg	Microgram
MCU	Microcontroller unit
mg	Milligram
mL	Milliliter
MPU	Microprocessor unit
ms	Millisecond
ns	nanosecond
PCL	Power control logic
psi	Pounds per square inch
PVT	Performance verification test
PWA	Printed wiring assembly
RAM	Random access memory
ROM	Read only memory
RTC	Real-time clock
SLA	Sealed lead acid
SPDT	Single pole double throw
SPI	Serial peripheral interface
SRAM	Static random access memory
UART	Universal asynchronous receiver transmitter
V	Volt
$\mathbf{V_{AC}}$	Volts alternating current
$\mathbf{V_{CC}}$	Collector supply voltage
$\mathbf{V_{DC}}$	Volts DC
VTBI	Volume to be infused
WDI	Watchdog input
µA	Microampere
µV	Microvolt

1.5 USER QUALIFICATION

The LifeCare PCA with Hospira MedNet infusion system is intended for use at the direction or under the supervision of licensed physicians or certified health care professionals who are trained in the use of the pump and the administration of parenteral and epidural fluids and drugs and the corresponding warnings and precautions. Training should emphasize the assessment and monitoring of patients receiving potent analgesic medications, and appropriate treatment for possible adverse reactions.

1.6 ARTIFACTS

Nonhazardous, low-level electrical potentials are commonly observed when fluids are administered using infusion devices. These potentials are well within accepted safety standards, but may create artifacts on voltage-sensing equipment such as ECG, EMG, and EEG machines. These artifacts vary at a rate that is associated with the infusion rate. If the monitoring machine is not operating correctly or has loose or defective connections to its sensing electrodes, these artifacts may be accentuated so as to simulate actual physiological signals.

To determine if the abnormality in the monitoring equipment is caused by the infuser instead of some other source in the environment, set the device so that it is temporarily not delivering fluid. Disappearance of the abnormality indicates that it was probably caused by electronic noise generated by the infuser. Proper setup and maintenance of the monitoring equipment should eliminate the artifact. Refer to the appropriate monitoring system documentation for setup and maintenance instructions.

1.7 ELECTROMAGNETIC COMPATIBILITY

The LifeCare PCA has been tested and found to comply with electromagnetic compatibility (EMC) limits for the Medical Device Directive 93/42/EEC (EN 55011 Class B and EN 60601-1-2:2001). These limits are designed to provide reasonable protection against harmful interference in a typical medical installation.

The equipment generates, uses, and may radiate radio frequency energy if not installed and used in accordance with the instructions. It may interfere with other devices in the vicinity ***(see the System Operating Manual)***.

⚠ **CAUTION: Portable and mobile RF communications equipment, such as cellular telephones, two-way radios, Bluetooth™ devices, and microwave ovens in close proximity to the infusion system may affect wireless and wired communications and degrade performance of the system. Operation of the infuser under such conditions should be avoided.**

There is a shared responsibility between manufacturers, customers, and users to assure that medical equipment and systems are designed and operated as intended. Medical electrical equipment requires special precautions regarding electromagnetic compatibility.

The electromagnetic environment should be managed to permit the infusion system to perform as intended without disturbing other equipment. The infusion system should not be used adjacent to or stacked with other equipment. If the device must be used adjacent to or stacked with other equipment, monitor the equipment to assure there is no electromagnetic interference, and verify normal infuser operation.

Use of a shielded Ethernet cable (CAT5 STP or better) for plugging into the RJ-45 connector is required. Using an unshielded Ethernet cable may result in increased emissions.

1.8
FCC INFORMATION

The LifeCare PCA has been tested and found to comply with the Class B limits and Class a/b/g digital devices for list number 20709, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference.

The wireless LAN device in the connectivity engine has been evaluated and found to be compliant with the requirements of FCC radio frequency exposure standards ***(see the System Operating Manual)***.

1.9
INFUSION SYSTEM INSTALLATION

⚠ **CAUTION: Infusion system damage may occur unless proper care is exercised during product unpacking and installation.**

Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC standards (e.g., IEC 60601-1 for medical equipment). Furthermore, all configurations shall comply with the system standard IEC 60601-1-1. Any person who connects additional equipment to the signal input or output part is configuring a medical system, and is therefore responsible for assuring that the system complies with the requirements of IEC 60601-1-1. If in doubt, **contact Hospira**.

Infusion system installation consists of unpacking, inspection, self test, and setting the time and date.

1.9.1
UNPACKING

Inspect the shipping container as detailed in ***Section 1.9.2***. Use care when unpacking the infusion system. Retain the packing slip and save all packing material in the event it is necessary to return the infuser to the factory. Verify the shipping container contains a copy of the ***System Operating Manual***.

1.9.2
INSPECTION

Inspect the shipping container for damage. Should any damage be found, contact the delivering carrier immediately.

⚠ **CAUTION: Inspect the infuser for evidence of damage. Do not use the device if it appears to be damaged. Should damage be found, contact Hospira.**

Inspect the infusion system periodically for signs of defects such as worn accessories, broken connections, or damaged cable assemblies. Also inspect the infuser after repair or during cleaning. Replace any damaged or defective external parts.

1.9.3
SELF TEST

⚠ **CAUTION: Do not place the infuser in service if the self test fails.**

If an alarm condition occurs during the self test, cycle the power and repeat the self test. If the alarm condition recurs, note the message and take corrective action ***(see Section 6)***. Repeat the self test. If the alarm condition continues to recur, remove the infuser from service and **contact Hospira**.

> **Note:** Do not place the infuser in service if the battery is not fully charged. To make certain the battery is fully charged, connect the infuser to AC power for16 hours.
>
> **Note:** When plugging the device into an AC power outlet, grasp the AC power cord plug and use a forward motion into the socket. Do not use a sideways motion. When unplugging the device, grasp the AC power cord plug and pull straight out. Do not pull out using the power cord cable and do not pull out at an angle.

To perform the self test, see ***Figure 1-1***, and proceed as follows:

1. Unlock and open the security door.
2. Plug the AC power cord into a grounded hospital grade, 120 V_{AC} or 240 V_{AC}, 50-60 Hz receptacle. Verify the AC plug indicator on the front panel is illuminated.

   > **Note:** If the quality of earth grounding source is in doubt, use battery power.
   >
   > **Note:** When the AC plug indicator is off and the battery indicator on the display is flashing, it is an indication that the infuser is operating on low battery power and should be recharged.

3. Press **[ON/OFF]** to turn on the power. The infuser will perform a self test verifying the integrity of the software, memory, and selected electronic functions.
4. Verify the time and date. To set the time and date, see ***Section 1.9.4***.

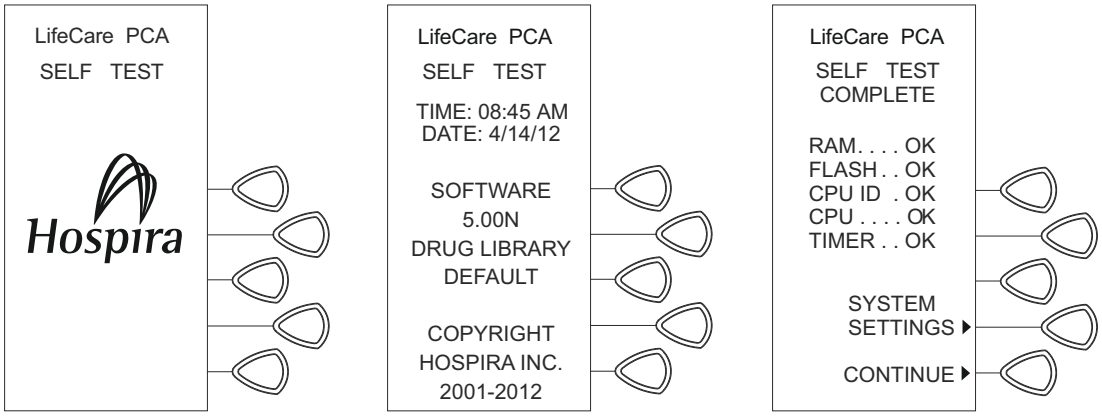

Figure 1-1. LifeCare PCA Self Test Screens

1.9.4
SETTING THE TIME AND DATE

To set the time and date, see ***Figure 1-2***, and proceed as follows:

1. Unlock and open the security door.
2. Press **[ON/OFF]** to turn on the power, and wait for the **SELF TEST COMPLETE** screen to appear.
3. Press the **[SYSTEM SETTINGS]** softkey, then press the **[TIME/DATE]** softkey. The screen displays **WARNING! CHANGING THE DATE OR TIME WILL CLEAR ALL TOTALS!**
4. Press the **[CONTINUE]** softkey.
5. Set the time using the keypad touchswitches. Press the **[AM/PM]** softkey to toggle AM/PM.

   Note: AM/PM option is available only in 12-hour clock format.
6. Press the **[NEXT]** softkey to continue.
7. Set the date using the keypad touchswitches, then press the **[NEXT]** softkey.
8. Press the **[CONFIRM]** softkey to accept current time and date settings, or press **[CHANGE]** to change time or date settings.
9. Verify the **SAVING DATE AND TIME** screen is displayed.
10. Verify the **SELECT SETTING TO CHANGE** screen is displayed.
11. Press the **[ON/OFF]** softkey when correct time and date are displayed.

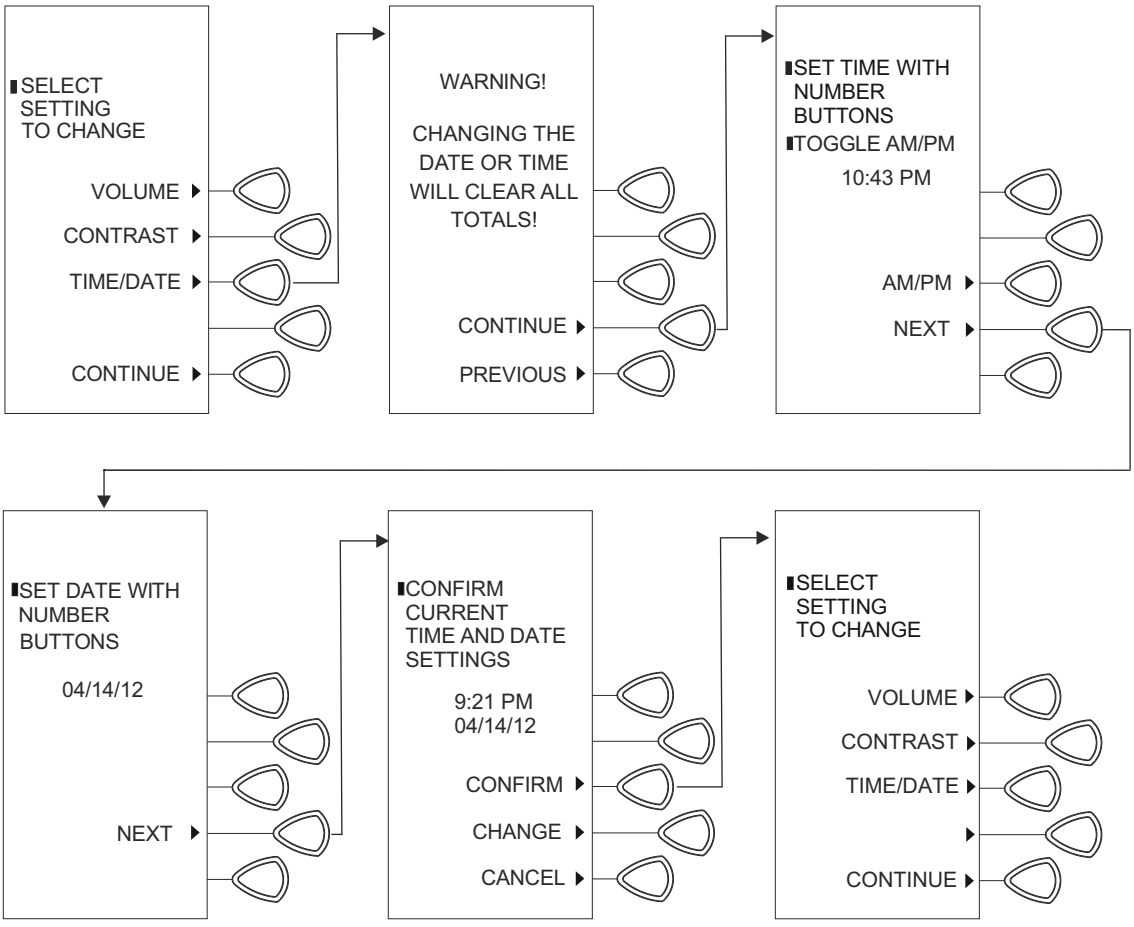

Figure 1-2. Setting the Time and Date

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Section 2

WARRANTY

Subject to the terms and conditions herein, Hospira, Inc., hereinafter referred to as Hospira, warrants that (a) the product shall conform to Hospira's standard specifications and be free from defects in material and workmanship under normal use and service for a period of one year after purchase, and (b) the replaceable battery shall be free from defects in material and workmanship under normal use and service for a period of 90 days after purchase. Hospira makes no other warranties, express or implied, and specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Purchaser's exclusive remedy shall be, at Hospira's option, the repair or replacement of the product. In no event shall Hospira's liability arising out of any cause whatsoever (whether such cause be based in contract, negligence, strict liability, other tort, or otherwise) exceed the price of such product, and in no event shall Hospira be liable for incidental, consequential, or special damages or losses or for lost business, revenues, or profits. Warranty product returned to Hospira must be properly packaged and sent freight prepaid.

The foregoing warranty shall be void in the event the product has been misused, damaged, altered, or used other than in accordance with product manuals so as, in Hospira's judgment, to affect its stability or reliability, or in the event the serial or lot number has been altered, effaced, or removed.

The foregoing warranty shall also be void in the event any person, including the Purchaser, performs or attempts to perform any major repair or other service on the product without having been trained by an authorized representative of Hospira and using Hospira documentation and approved spare parts. For purposes of the preceding sentence, "major repair or other service" means any repair or service other than the replacement of accessory items such as batteries and detachable AC power cords.

In providing any parts for repair or service of the product, Hospira shall have no responsibility or liability for the actions or inactions of the person performing such repair or service, regardless of whether such person has been trained to perform such repair or service. It is understood and acknowledged that any person other than a Hospira representative performing repair or service is not an authorized agent of Hospira.

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Section 3

SYSTEM OPERATING MANUAL

A copy of the ***System Operating Manual*** is included with every LifeCare PCA with Hospira MedNet infusion system. If a copy is not available, **contact Hospira *(see Section 6.1)***.

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Section 4

THEORY OF OPERATION

This section describes the infusion system theory of operation. The theory of operation details the general description, electronics overview, and communication engine.

4.1 GENERAL DESCRIPTION

The LifeCare PCA includes the following features:

Therapies	PCA Continuous PCA + Continuous
Battery	Battery icon 8 V battery pack
Biomedical	Serial communication Field upgradability Diagnostics setup options Alarm history
Options	Volume Infused history
Other features	Microprocessor control LCD screen LED display Panel back illumination on mains power Security features Prefilled and sterile empty vials Automatic drug identification via barcode reader

4.2 INFUSER ELECTRONICS OVERVIEW

LifeCare PCA infusion system electronics include:

- Power supply module
- Supervision circuitry
- Battery charger
- Logic interface
- LCD interface
- Keypad interface
- Ethernet port
- Barcode reader
- Patient pendant
- Real-time clock
- Alarm logic
- Memory

4.2.1
POWER SUPPLY MODULE

The power supply module provides regulated DC power to infuser electronics from the AC mains, including providing power to the MCU PWA and CE PWA. AC power is converted to 12 V_{DC} by a switching power supply circuit. There are no adjustments or settings.

4.2.2
INPUT POWER LOGIC

The input power logic contains the following:

- Input voltage switch-over circuitry
- Eternal power circuitry
- Power control logic circuitry
- Power interface to communication engine (CE)

4.2.2.1
INPUT VOLTAGE SWITCH-OVER CIRCUITRY

The operation of the LifeCare PCA electronics is ordinarily powered by the AC power supply (+12 V). If AC power is absent, the sealed lead acid (SLA) battery (Vbat) powers the logic. If the SLA battery fails, the control logic briefly operates from a charge stored in a supercap (Vsc). These three power sources are diode connected to drive the unregulated Vbus rail. The Vbus rail powers an eternal 3.3 volt regulator (V3.3), and is the input to the main power switch.

4.2.2.2
ETERNAL POWER CIRCUITRY

The eternal 3.3 volt power (V3.3) is a continuous source of power for the data memory, real-time clock (RTC), and power control logic (PCL). The V3.3 regulator has a very low (20 µA max) quiescent current to prolong the operation while on portable power. The logic automatically switches V_{mem}, power for the data memory and RTC, over to the lithium backup battery (VLiBat) if the normal power from the AC and sealed lead acid battery fails.

The supercap continues to provide operating power to the PCL, RTC, and data memory for at least ten minutes after removal of AC and SLA battery power.

4.2.2.3
POWER CONTROL LOGIC CIRCUITRY

Power control logic (PCL) circuitry controls the logic power switch. Any of four events initiate power up:

- AC power on (AC_ON)
- SWon* (front panel power on)
- VialSW* (vial switch)
- InjSw* (injector clamp switch)

The switch inputs are normally open and pulled high to V3.3. Any high-to-low transition is latched as a power on event (Start) and EnableV is set. AC_ON is true when AC power is applied and stable for greater than approximately 500 ms. Without input from SWon*, VialSw*, or InjSw*, the displays are blanked and battery charging begins.

Following the switch on event, the microcontroller asserts Pwrhld (MCU Run). The software initialization has tests of the hardware, and test of the primary watchdog, that generates a second reset* while Pwrhld is still asserted. This reset* then clears the Pwrhld bit. The PCL continues to hold EnableV true until Pwrhld is restored.

Any subsequent actuation of the front panel power on key is a request to the MCU to shut down, and Sw_Off is signaled. A normal, controlled shutdown occurs as the microcontroller de-asserts Pwrhld if AC power is off. If AC power is present, the infuser remains powered until AC power is removed.

4.2.2.4
POWER INTERFACE TO CE

The CE is powered by the MCU PWA using VMOT as the source of power. The MCU has a 4-pin power connector to VMOT, ground, and POWER CE OFF*. The power control signal, POWER CE OFF* enables and disables power to the CE. Power to the CE is disabled when POWER CE OFF* is driven logic low and enabled when POWER CE OFF* is driven logic high.

4.2.3
VOLTAGE SUPERVISION CIRCUIT

The unregulated switched bus voltage, VMOT, is monitored by Watchdog1, and produces a high priority interrupt (IRQ0*) to the microcontroller in advance of loss of operating power at 5.8 V_{DC} ± 0.2 V_{DC}. The microcontroller has approximately 0.5 ms to prepare for loss of power and reset (orderly shutdown).

The +12V input is AC power, and is monitored by Watchdog2. The input is buffered through the PCL and labeled AC_ON. Upon loss of AC power, the microcontroller discontinues charging the battery if that is in process. The threshold point occurs at 10 ± 0.2 volts.

4.2.4
MICROCONTROLLER SUPERVISION CIRCUIT

It is important to protect the system during power transitions, and the microcontroller must be rebooted after the V_{CC} power supply is applied. The microprocessor supervisory circuit generates a reset pulse during power up and holds the processor in reset during power down.

When V3.3sw falls below the reset threshold voltage of 2.9 V (typically), the primary watchdog reset* signal goes active low and holds the microprocessor in reset. When V3.3sw rises above the threshold voltage, the reset* remains active low for a minimum of 140 ms.

The timer function of Watchdog1 monitors the activity of the microprocessor. If the microprocessor does not toggle the Watchdog1 input (wd_strobe) within the timeout period, reset* is forced to active low and the alarm logic sounds the alarm. The timeout interval may be as short as 1.2 seconds. The watchdog service must execute at a period not to exceed one second.

4.2.5
LITHIUM BATTERY BACKUP

A lithium coin cell battery provides emergency standby power to the RTC and SRAM if the SLA battery is disabled and AC power is off.

The lithium battery discharge current will be less than 26 µA at approximately 25 C temperature. The voltage developed across a 2 K series limiter resistor provides the measure of the drain current. The test point is labeled VLi.

4.2.6
BATTERY CHARGER

When a battery is discharged, its terminal voltage will be less than 7.8 volts (1.95 volts per cell) with the charger off. A discharged battery has a depleted electrolyte that is very resistive (non-conductive). When a charge current is first applied, the terminal voltage rises as a function of the effective IR drop developed in series with the cell voltage. The voltage output of the charger is limited to 9.5 volts to protect the battery from overstress during charging.

> **Note:** The only exception to this limit is during the battery presence check, when the battery voltage can be over 11 volts for just over 10 seconds. This check determines if the battery is connected, allowing the user the option to continue to use the infuser with the battery disconnected.

As the battery begins to accept a charge, the electrolyte becomes more conductive and the terminal voltage drops as the IR drop is less. The cell voltage then rises as it charges. When a cell is fully charged, any additional charge is wasted as disassociation of the water into hydrogen and oxygen. The gas bubbles accumulate on the plates, and the resistance rises. Overcharging is marked by a rapid rise in terminal voltage, as the added IR drop is summed with the fully charged cell voltage.

A fully charged battery has a terminal voltage greater than 8.6 volts (2.15 volts per cell times four cells) with the charger off. If the terminal voltage is less than 9 volts but greater than 8.6 volts, the charger can be enabled in the low charge mode until the terminal voltage rises to 9.3 volts, or the charge time has elapsed.

After the battery has been brought to the fully charged condition, the charger is shut off and the trickle charge takes over with a float voltage of 9.2 V (2.3 volts per cell times four cells).

Rapid charging at 1 A is limited to 202 minutes, or 125 % of the 2.7 AHr capacity of the SLA. If the battery reaches 9.3 volts during rapid charge, rapid charging is continued for 25 % of the time that it took to reach the 9.3 volt threshold. For example, the charger is enabled and rapid charge is applied for 120 minutes. Then rapid charging is continued for an additional 30 minutes.

If rapid charging was successfully achieved, then low charge rate charging is to be continued for 50 % of the time needed to rapid charge to the 9.3 volt threshold. As in the previous example, 60 minutes at the low charge rate is needed to finish charging the battery.

4.2.6.1
LOW BATTERY DETECTION

If, during battery operation (no AC power, charger off), the terminal voltage falls below 7.6 volts for more than three seconds (owing to IR drops internal to the battery and fuse while the cell voltage times four is actually 7.8 volts) the battery is low, and the **LOW BATTERY** alarm state is triggered.

4.2.6.2
DISCHARGED BATTERY DETECTION

If, during battery operation (no AC power, charger off), the terminal voltage falls below 7.2 volts for more than three seconds (owing to IR drops internal to the battery and fuse while the cell voltage times four is actually 7.4 volts) the battery is discharged, and the **DEAD BATTERY** alarm state is triggered.

4.2.7
LOGIC INTERFACE

The logic interface is a bridge of the microcontroller's bus timing to the timing requirements of the peripheral devices. The processor and its memory operate at full bus speeds, but the LCD display in particular is not able to respond as fast. The logic supports address decode for the LED interface, hardware control latch, serial address decode, and serial data splitter.

4.2.7.1
GLUE LOGIC – LCD I/O

A function of the glue logic is to generate the timing needed by the display when accessed by the processor.

The LCD requires the following signals:

- Data Bus Gating: The direction control and output enabling of the 8-bit data bus transceiver. The LCD data bus is active only when the processor accesses the LCD (to limit EMI).
- Eclk Generation: The LCD uses early Motorola 6800 timing. Address and read/write control is clocked into the LCD. Eclk is at least 450 ns wide, and delayed at least 150 ns after setup of chip selects. Eclk is active only when the processor accesses the LCD.
- Address Decode: CS1 is a positive logic chip select for the lower 64 x 64 display interface. CS2 is the control for the upper half of the LCD.
- Register Select: LCD_A0 selects between data and control register access of each LCD controller. LCD_A0 selects data when high, control or status is accessed when low. LCD_A0 is active only when the processor accesses the LCD.

4.2.7.2
GLUE LOGIC – SERIAL I/O CHANNEL ENABLE

The microcontroller has two serial interfaces: one for the communications to CE, and one for the MCU serial UART used for barcode access. A third serial peripheral interface (SPI) is discretely (bit-by-bit) developed by the MCU on its hardware I/O.

The serial interfaces operate independently of each other and the other microcontroller processes. The serial peripheral interface is shared between two devices, so only one may be enabled for each channel at any one time. The serial peripheral interface is the data link to the RTC and the analog-to-digital converter (ADC).

4.2.8
LCD INTERFACE

A 128 x 64 pixel LCD in portrait orientation is the main user display. The LCD module is based on two Hitachi HD61202 (or equivalent) column drivers. This is a CMOS logic operating from the 5 volt supply. Since basic CMOS is not logically compatible with TTL or 3.3 volt logic, a bridge interface is required between the two. The bridge is made from a buffer/translator (74LVC573A), and a simple HCT buffer (74HCT244) operating from the 5 volt supply. The glue logic provides address decoding and Eclk generation ***(see Section 4.2.7.1)***.

4.2.8.1
LCD MODULE

Each LCD driver controls 64 x 64 pixels. Since the display is turned sideways for the portrait aspect ratio, the origin or zero address of the data displayed is the lower left corner, and is eight pixels wide. The least significant bit is found at the left most pixel. The access to the 64 x 64 space is divided into a 6-bit Y-axis pointer, and a 4-bit X-axis segment (each eight pixels wide) pointer. The Y-axis address pointer auto-increments to the next display location with each write or read to the data display memory. At overflow of the Y-axis pointer, it returns to the bottom of the display. The second HD61202 is accessed to control the upper set of 64 x 64 pixels.

The display start line register (DSLR) can be used to scroll the display left or right. The scrolled display wraps one edge to the other. Normally, it is expected that the DSLR is set to zero.

4.2.8.2
LCD CONTRAST

The LCD contrast is set by an analog control voltage that is adjustable between +5 volts and – 4.5 volts. The LCD module generates a negative – 4.5 volt bias for this purpose (V-5). The MCU controls this node (LCD_Adj) by a PWM signal LCD through an inverting low pass amplifier.

4.2.8.3
LCD BACKLIGHT

A yellow LED panel is integral to the LCD module for the backlight of the LCD display. The MCU PWM port line, BACKLT_EN, controls whether the LED panel is on or off. When the BACKLT_EN is active high, the LCD backlight panel is turned on. The LCD backlight is driven by a constant current regulator (SEPIC controller LT1513) operating from the unregulated supply VMOT. The LCD backlight is driven at 250 mA ± 20 mA, when enabled at standard brightness. When boost is enabled, the backlight may draw 600 - 700 mA.

4.2.8.4
BATTERY INDICATOR

A red LED light bar back-illuminates the battery graphic symbol on the front panel. The control of the battery indicator is independent from the numeric digits and AC indicator. The battery indicator is controlled by bit D13. The battery indicator draws approximately 10 mA.

4.2.8.5
AC POWER INDICATOR

A green LED light bar back-illuminates the AC power graphic symbol on the front panel. The AC power indicator is active anytime +12V is present and is not controlled by the MCU. The AC power indicator draws approximately 10 mA.

4.2.9
KEYPAD INTERFACE

A keypad is used for operator control and data entry. A 4 x 6 switch matrix keypad connects to the MCU PWA through two 8-pin flat-flex connectors. The keypad provides a separate hardware power on and power off switch with momentary contacts to a common pin. The keypad has ESD shielding. Additional ESD protection is provided by a high speed clamp (SP720) at each input pin. The MCU scans the rows; setting one bit of six outputs low through an open drain inverter. It reads the column return (with pull-ups).

4.2.10
BARCODE READER

The barcode reader (BCR) communicates with the MCU PWA using RS-232 logic levels and serial protocols. The connection is made by a 6-pin, locking, polarized connector.

The baud rate, word length, start/stop bits, and parity settings are internally generated by the MCU. The settings are 9600 baud, 8-bit data, one start bit, one stop bit, and no parity.

When enabled, a high-side switch delivers 5 volts to the BCR. The reader current is approximately 200 mA. To preserve power, the reader is only enabled for a brief time after detection of vial insertion. The reader asynchronously transmits a string each time a barcode is presented to the reader.

4.2.11
PATIENT PENDANT

The patient pendant is a normally open SPDT switch connected to the infuser with a 1/4 inch stereo phone jack. The sleeve contact of the phone jack is at common. The tip contact is the normally open signal PCA*.

The jack is metal threaded and bulkhead mounted on the rear of the device. A harness connects the jack to the MCU PWA with a 4-pin, locking, polarized connector.

> **Note:** The LifeCare PCA patient pendant cord is color-coded blue. The LifeCare PCA patient pendant switch button is color-coded black.

4.2.11.1
PCA INPUT

Activation of the patient pendant switch results in signal PCA* going low as long as the switch is held. The third signal, PPP*, is low if the cable is connected and the pendant is not pressed. This provides positive identification of a correct and functioning patient pendant.

4.2.12
NURSE CALL

The nurse call relay contacts are accessed using a 1/4 inch phone jack located on the rear of the enclosure. The nurse call relay is a latching contact relay that can be set as either normally open or normally closed. When the infuser is turned off, the relay contacts stay latched in the position they were in when power was removed.

The factory default setting for the nurse call relay is normally open. However, this setting can be changed using the Biomed mode.

In the normally open configuration, when there is a malfunction or alarm that triggers the nurse call, the nurse call contact goes from open to closed.

4.2.13
DOOR SENSOR

The door sensor is a normally open SPDT switch internal to the door latch mechanism. The normally closed contact is not used. A harness connects the sensor to the MCU PWA with a 4-pin, locking, polarized connector.

Closure and locking of the door trips the switch with the signal Door* going low as long as the door is closed and locked.

4.2.14
MECHANISM ASSEMBLY

The mechanism assembly drives an inverted syringe from a lead screw and stepper motor drive. Sensors in the mechanism monitor the syringe, drive position, and loading force ***(see Figure 4-1)***.

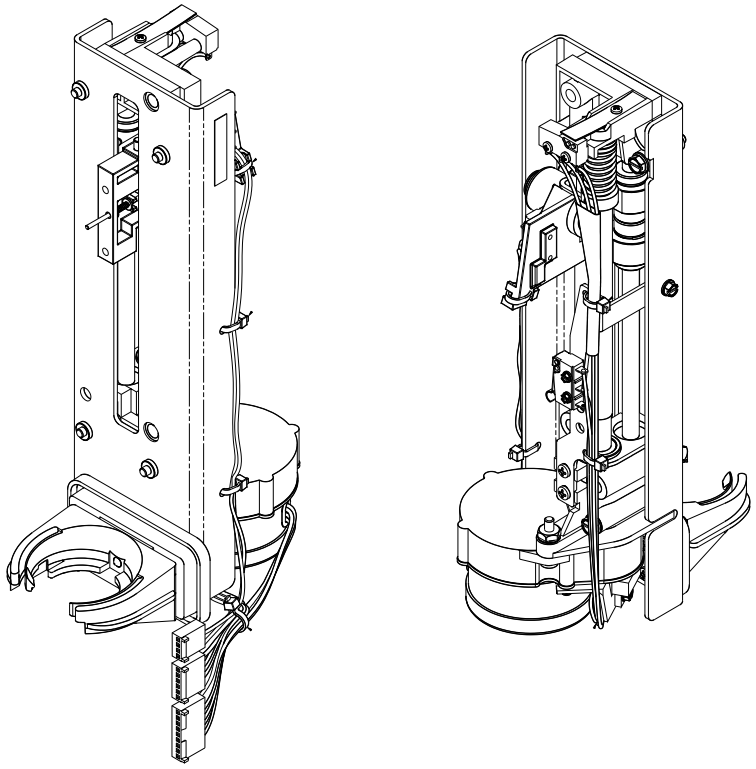


Figure 4-1. Mechanism Assembly

4.2.14.1
VIAL SENSOR

The vial sensor is a normally open SPDT switch behind the cradle that moves as the syringe is emptied. The normally closed contact is not used. A harness connects the sensor to the MCU PWA.

Installation of a drug container into the cradle activates the switch with the signal VialSw* going low as long as the container is left in place.

4.2.14.2
INJECTOR CLAMP SENSOR

The injector clamp sensor is a normally open SPDT switch behind the clamp at the bottom of the mechanism. The normally closed contact is not used. A harness connects the sensor to the MCU PWA that is common with the syringe empty and pressure occlusion sensors.

Installation of a drug container into the clamp trips the switch with the signal InjSw* going low as long as the container is left in place.

4.2.14.3
SYRINGE EMPTY SENSOR

The syringe empty sensor is a normally open SPDT switch fixed to sense the travel of the lead screw and cradle mechanism. The normally closed contact is not used.

Passage of the cradle as the container is emptied trips the switch, with the signal SyrngMT* going low as long as the container is nearly empty or the cradle is left at the bottom of its travel.

4.2.14.4
PRESSURE OCCLUSION SENSOR

The pressure occlusion sensor is an SPDT switch fixed to sense the thrust load of the lead screw and cradle mechanism.

A leaf spring holds the switch closed. When approximately 15 psi ±5 psi force is generated in the mechanism, the leaf is released, and trips the switch. The signal PresLim* goes low as long as the pressure is maintained.

4.2.14.5
SHAFT SENSOR

A slotted optical interrupter sensor monitors a mechanical flag coupled to the rotation of the lead screw with a flat extension. Each revolution opens and closes the slotted optical path. The connections to the sensor are combined with the motor.

The sensor is enabled by the active high SNSRTST signal. The sensor output is valid one ms after setting SNSRTST.

The sensor output, PMP_FLG, is high if the sensor's optical path is blocked or if the sensors are not enabled. The LED drive current will be 10 mA.

4.2.14.6
DUAL BIPOLAR DRIVE

The motor drive is a major current drain in the operation of the infusion system. To conserve power, a bipolar constant current drive is used. This motor has two windings that are electrically 90° out of phase ***(see Figure 4-2)***.

A chopper circuit regulates the current in each winding. The coil current magnitude is preset to one of three settings (high, low, or off) by the I_SET and MotEN* bits. The motor current polarity is controlled by the signals MotAph and MotBph for sequencing ***(see Table 4-1)***.

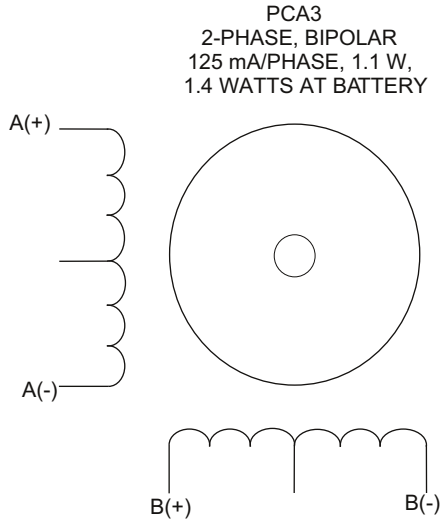


Figure 4-2. Dual Bipolar Drive

Table 4-1. Motor Step Table		
MotBph	**MotAph**	**Step Sequence**
1	0	1
1	1	2
0	1	3
0	0	4

4.2.15
REAL-TIME CLOCK

The real-time clock (RTC) is a serial peripheral to the microcontroller that provides calendar, day-of-the-week, hours-minutes-seconds time keeping and extra storage in 31 x 8 RAM. The RTC operates from the eternal logic power or the lithium battery.

4.2.16
ALARM LOGIC

The MCU PWA controls an audible buzzer that is activated either under software control, during MCU reset period, or under catastrophic failure.

4.2.16.1
NORMAL ALARM

The audible alarm sounds each time the infuser powers on. The microcontroller inhibits the logic after it wakes up. The default volume at power on is set to maximum.

4.2.16.2
CRITICAL FAILURE ALARM

During a critical failure, the audible alarm will be continuous. A critical failure is any event that trips the watchdog reset* without first clearing the EnableV bit. The alarm continues for several seconds while powered from a stored charge (supercap) in the event of failure of the SLA battery.

4.2.16.3
NORMAL SHUTDOWN INHIBIT

The power down sequence is initiated by the microcontroller through the power control logic that de-asserts EnableV. If EnableV is low when reset* occurs, the alarm is inhibited.

4.2.16.4
VOLUME CONTROL

The alarm volume can be set to low, medium, or high. The difference in volume between settings will be between 10 dB to 20 dB. The low alarm volume is at least 45 dB.

4.2.16.5
ALARM TONE

The alarm tone is a fixed frequency between 2000 and 4000 Hz. The alarm is set at the factory to generate maximum volume.

> **Note:** The alarm volume, if operated with opened enclosure, is greater than 95 dB. At this dB level hearing protection may be required.

4.2.16.6
NORMAL KEY TONE

Activating the alarm for 10 to 50 ms at medium volume indicates valid keypad input.

4.2.17
PROGRAM MEMORY

The program code is stored in a 256 K x 16 flash ROM. The flash memory is to be erased and rewritten in-circuit. The erasure and reprogramming is accomplished by protected servicing operation.

4.2.18
DATA MEMORY

The data storage is to be a 128 K x 8 SRAM with low standby current drain. The RAM is continuously powered from the eternal supply voltage, Vmem, to provide non-volatility. Critical data is checksummed for security.

4.3
PCA COMMUNICATION ENGINE

The Communication Engine (CE) is a combination of a digital processor module and an 802.11 a/b/g wireless module or an 802.11 b wireless module for list number 20709.

The controller consists of two PWAs: the primary PWA, called the CE, and the secondary PWA, called the I/O board ***(see Figure 4-3)***. The I/O board contains all externally accessible connectors. These two boards are interconnected with a 10-pin ribbon cable.

The CE PWA has 16-bit flash memory (4M x 16) with a 64-megabit memory size. The SDRAM memory is 32-bit (4M x 32), with a 128-megabit memory size.

The processor circuitry includes the processor, its memory devices, the RS-232 interface, the USB interface, the Ethernet interface and isolation, clock oscillators, reset control, LED indicators, and power regulation for all of these parts.

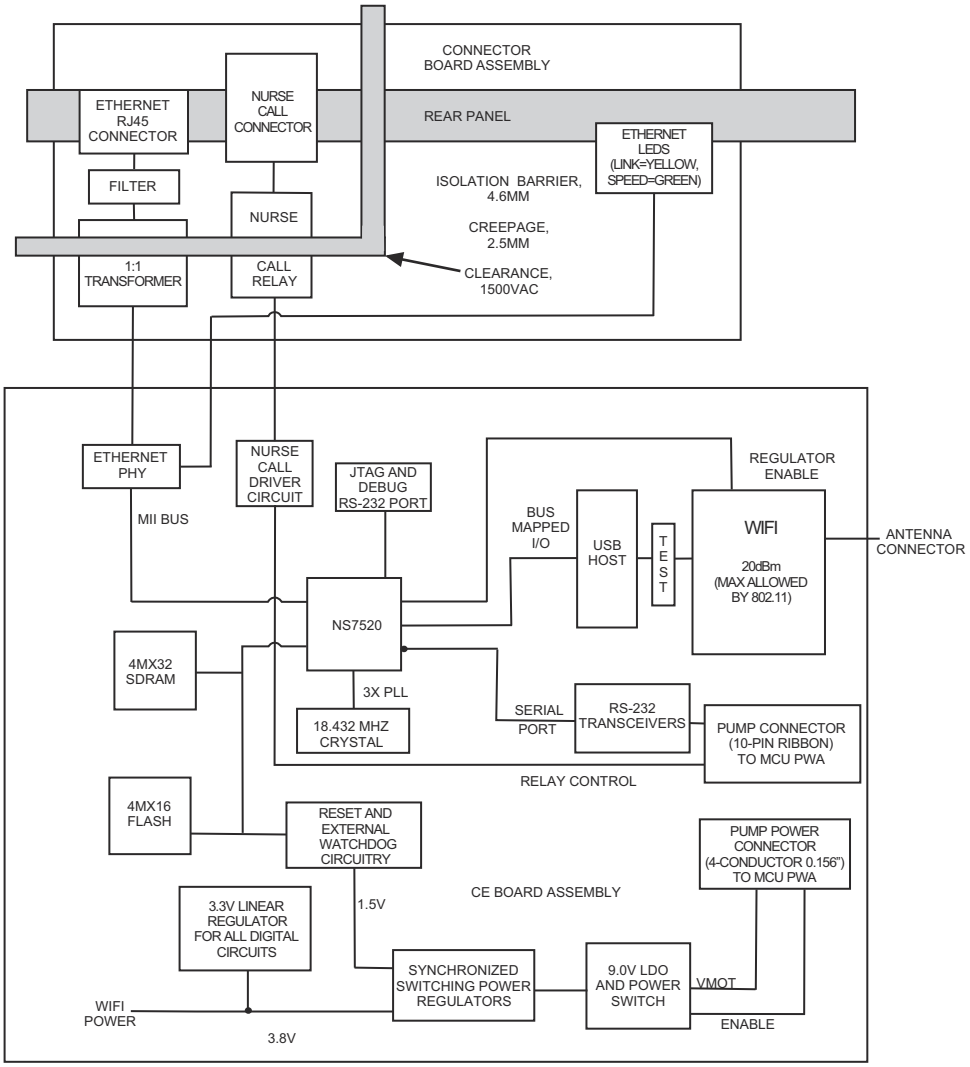


Figure 4-3. PCA Controller

4.3.1
ETHERNET PORT

The CE supports external wired communications based on the IEEE 802.3 specifications. The connector on the rear of the enclosure is a standard RJ-45 Ethernet connector. The speed of the data is 10 MHz or 100 MHz based on the 10BaseT and 100BaseT standard respectively. The letter **T** designates twisted wire pairs for the connection cable. The Ethernet port meets the IEEE 802.3 specification of a minimum DC isolation of 1500 Vrms.

4.3.2
I/O PWA

The I/O PWA is located in the rear enclosure. The I/O is the external electronic interface to the CE PWA and MCU PWA, and connects directly to the CE via a 10-pin connector and cable. The I/O contains the RJ-45 jack (wired Ethernet communications), nurse call, green and yellow LED Ethernet indicators, and an isolation barrier.

4.3.3
WIRELESS COMMUNICATIONS (WIFI)

The wireless (WiFi) communications are based on standards IEEE 802.11 a/b/g or IEEE 802.11 b for list number 20709. The WiFi chipset that generates the wireless signals is located on the CE PWA. The internal communications interface between the CE processor and WiFi is the CE PWA USB (host). The WiFi contains an output amplifier calibrated to support transmit power levels of 20 dB. The WiFi uses a single antenna design for external communications ***(see Section 4.3.4)***. The antenna is connected to the WiFi using a cable and SMA connector J2 located on the CE PWA. The connection to the antenna PWA is soldered.

4.3.4
ANTENNA PWA

The antenna PWA is connected to the WiFi (wireless) section of the CE PWA. The design is a single antenna mounted on the PWA that is housed under a dome shaped plastic cover on top of the front enclosure. All wireless communications are performed via the antenna.

4.3.5
CE PWA TO MCU PWA

All data communication between the CE PWA and the MCU PWA is performed using the serial RS-232 port. The MCU PWA flash memory is programmed using this port, following a path through the CE processor back to the RJ-45 jack on the I/O PWA.

4.3.6
LED INDICATORS

The two LED indicators on the rear of the device indicate the status of the Ethernet signal. The yellow LED lights when the auto-negotiate circuit has selected a data rate and blinks when data is being transmitted. The green LED indicates transmission speed. It turns on when the data rate is 100BaseT, and turns off when the data rate is 10BaseT.

Section 5

MAINTENANCE AND SERVICE TESTS

A complete maintenance program promotes infusion system longevity and trouble-free operation. Such a program should include cleaning, Preventive Maintenance, and the Performance Verification Test (PVT).

5.1 CLEANING AND SANITIZING

As a minimum requirement, inspect and clean the infuser after each use. In addition, establish a regular cleaning schedule for the device.

Practice the cleaning and sanitizing guidelines in this section. Follow hospital protocol for establishing the infuser cleaning schedule.

Before cleaning, turn off the infuser and disconnect from AC power.

Clean the exposed surfaces of the infuser with a soft, lint-free cloth moistened with one of the cleaning solutions recommended in ***Table 5-1***, or with a mild solution of soapy water. Remove soap residue with clear water.

WARNING: DISCONNECT THE INFUSER FROM AC POWER PRIOR TO CLEANING THE DEVICE. FAILURE TO COMPLY WITH THIS WARNING COULD RESULT IN ELECTRICAL SHOCK.

CAUTION: For proper functioning of the barcode reader, keep the barcode reader window clean. For cleaning, use recommended CleanTex™ CT 811 OpticPad™ Optic Surface Cleaner or a soft, lint-free cloth moistened with a streak-free optical glass cleaner. To avoid fluid ingress, do not spray fluids or cleaning solutions on the barcode reader window and press lightly on the barcode reader window while cleaning.

CAUTION: To avoid mechanical or electronic damage, do not immerse the infuser in fluids or cleaning solutions. Do not spray cleaning solutions toward any openings in the device, or directly on the device.

CAUTION: Use only recommended cleaning solutions and follow manufacturers' recommendations. Using cleaning solutions not recommended by Hospira may result in product damage. Do not use compounds containing combinations of isopropyl alcohol and dimethyl benzyl ammonium chloride.

CAUTION: Never use sharp objects such as fingernails, paper clips, or needles, to clean any part of the infuser. Use only soft cloths or sponges. Do not sterilize by heat, steam, ethylene oxide (ETO), or radiation.

Note: Disinfecting properties of cleaning solutions vary, and not all cleaning solutions are sanitizers. Check product labeling or consult the manufacturer for specific information.

Note: At the time of publication, Hospira recommends only the cleaning solutions in ***Table 5-1***. For updated listings of approved cleaners, visit **www.hospiraparts.com**.

Table 5-1. Cleaning Solutions

Cleaning Solution	Manufacturer	Preparation
Dispatch™ Hospital Cleaner Disinfectant with Bleach	Caltech Industries	Per manufacturer's recommendation
Formula C™	JohnsonDiversey	Per manufacturer's recommendation
Precise™ Hospital Foam Cleaner Disinfectant	Caltech Industries	Per manufacturer's recommendation
Sani-Cloth™ HB Wipe	Professional Disposables	Per manufacturer's recommendation
Sani-Cloth™ Bleach Wipe	Professional Disposables	Per manufacturer's recommendation
Sporicidin™	Sporicidin	Per manufacturer's recommendation
Vesphene™ IIse	Steris	Per manufacturer's recommendation
Household Bleach	Various	Use per hospital procedures Do not exceed one part bleach in ten parts water

5.2
PREVENTIVE MAINTENANCE

Hospira requires that preventive maintenance be performed at least once every **12 months**. Replace components as required by visual inspection and test results.

Complete the ***Preventive Maintenance Checklist*** in ***Section 5.2.1***.

- The sealed, lead-acid battery must be replaced at least once every **24 months**.
- The mechanism assembly must be replaced at least once every **60 months** ***(see Figure 7-8)***.
- The coin cell battery must be replaced at least once every **120 months**.
- Perform the Performance Verification Test at least once every **12 months** along with the visual inspections.

Perform the preventive maintenance inspections and tests according to the following steps:

1. ***Section 5.2.1, Preventive Maintenance Checklist***
2. ***Section 5.2.2, AC Power Cord Inspection and Test***
3. ***Section 5.2.3, Front Enclosure, Rear Enclosure, Cradle Assembly, and Security Door Inspection and Test***
4. ***Section 5.2.4, Rubber Foot Pad Inspection***
5. ***Section 5.2.5, Pole Clamp Assembly Inspection and Test***
6. ***Section 5.2.6, Keypad, Displays (LED/LCD), and Indicators Inspection***
7. ***Section 5.2.7, Patient Pendant Inspection***
8. ***Section 5.2.8, Barcode Reader Window Inspection, Test, and Cleaning***

5.2.1
PREVENTIVE MAINTENANCE CHECKLIST

The **Preventive Maintenance** process must be performed at least once every 12 months to ensure proper performance of the PCA infuser. In addition, inspect the infusion system after repair or during cleaning. Replace any damaged or defective external parts as required.

Perform the **Performance Verification** tests as described in ***Section 5.3***, and replace components as described in ***Section 7***.

Hospira

LifeCare PCA with MedNet Infusion System

Preventive Maintenance Checklist

- Circle **PASS** or **FAIL** in the respective box after each inspection or test is performed.
- Enter the device model and serial number in the space provided.
- Sign and date this checklist in the space provided.

Item	Inspection	Test
AC Power Cord Inspection and Test	PASS / FAIL	PASS / FAIL
Front Enclosure, Rear Enclosure, Cradle Assembly, and Security Door Inspection and Test	PASS / FAIL	PASS / FAIL
Rubber Foot Pad Inspection	PASS / FAIL	
Pole Clamp Assembly Inspection and Test	PASS / FAIL	PASS / FAIL
Keypad, Displays (LED/LCD), and Indicators Inspection	PASS / FAIL	PASS / FAIL
Patient Pendant Inspection	PASS / FAIL	PASS / FAIL
Barcode Reader Window Inspection, Test, and Cleaning	PASS / FAIL	PASS / FAIL
Self Test		PASS / FAIL
Biomed Mode Tests		PASS / FAIL
Delivery Accuracy Test		PASS / FAIL
Occlusion Test		PASS / FAIL
Electrical Safety Test		PASS / FAIL
Connectivity Check		PASS / FAIL
	Battery Replaced?	YES / NO

TECHNICIAN	INFUSER
Signature: _____	Model: _____
Date: _____	Serial Number: _____

5.2.2
AC POWER CORD INSPECTION AND TEST

Inspect and test the AC power cord at least once every 12 months.

The recommended tool for this procedure is a #2 Phillips screwdriver.

To inspect the AC power cord, see ***Figure 5-1***, and proceed as follows:

1. Turn off the infuser and disconnect the device from AC power.
2. Using the Phillips screwdriver, remove the screw that secures the battery door, and remove the door and door pad.
3. Disconnect the power cord from the infuser's AC power receptacle.
4. Inspect the receptacle for missing screws, and replace, as required.
5. Verify the power cord cable is free from cracks, fraying, and/or torn insulation. If any damage is observed, replace the power cord ***(see Section 7.3.5)***.
6. Inspect both ends of the power cord for any signs of electrical arcing, burn marks, or heat scorching or melting. If any damage is observed, replace the power cord.
7. Inspect the plug end of the power cord for bent blades or a loose or missing ground pin. If any damage is observed, replace the power cord.
8. Inspect the power cord retaining strap for damage. If any damage is observed, replace the strap.
9. When inspections are completed, plug the power cord into the AC power receptacle and reinstall the battery door and door pad ***(see Section 7.3.5)***.
10. Connect the infuser to AC power and confirm the AC indicator is lit.

To test the AC power cord, perform the **Electrical Safety Test** in the **PVT** ***(see Section 5.3.7)***.

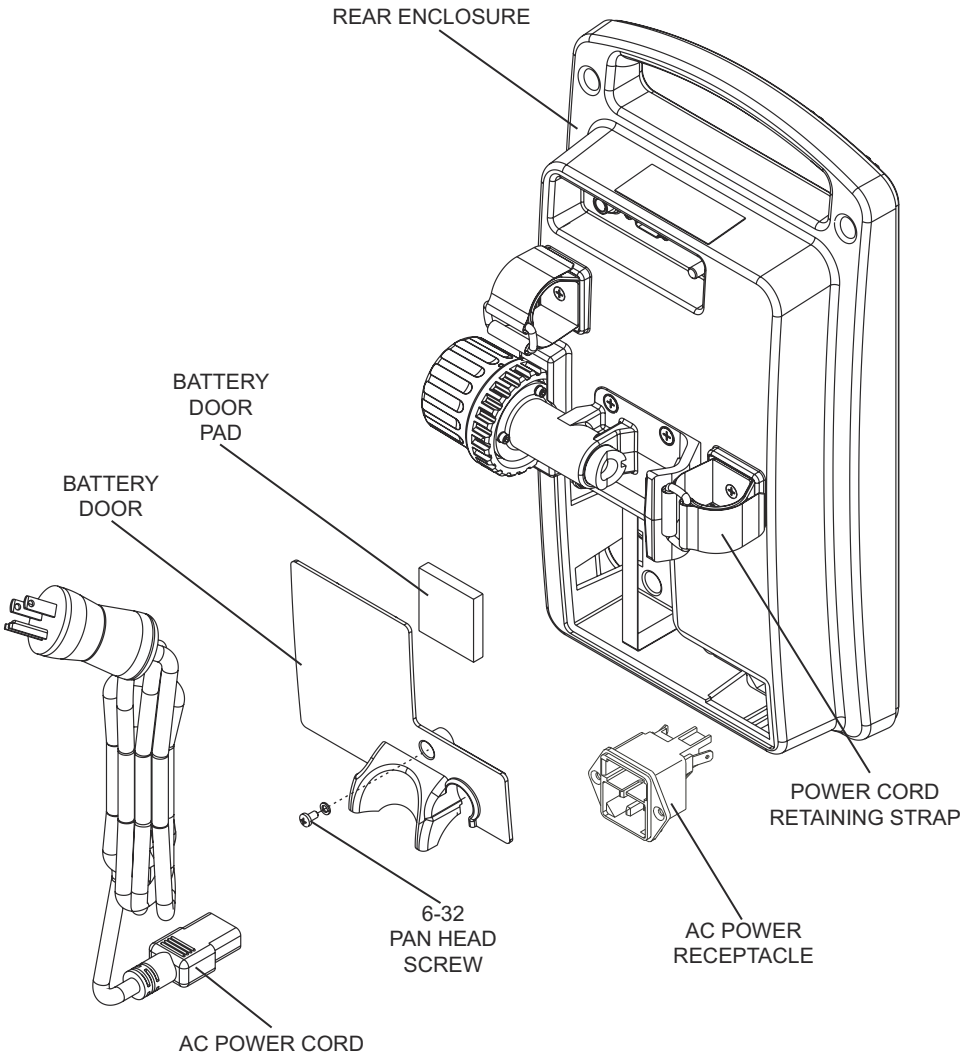


Figure 5-1. AC Power Cord Assembly

5.2.3
FRONT ENCLOSURE, REAR ENCLOSURE, CRADLE ASSEMBLY, AND SECURITY DOOR INSPECTION AND TEST

Inspect the front and rear enclosures, cradle assembly, and security door at least once every 12 months.

Recommended materials for this procedure are a LifeCare PCA vial and injector, and a security key.

To inspect the enclosures, cradle assembly, and security door, see ***Figure 5-2***, and proceed as follows:

1. Place the infuser on a flat, stable surface.
2. Inspect the front and rear enclosures for cracks, chips, and gouges. If an enclosure is cracked, or has a significant chip or gouge, replace the damaged part ***(see Section 7.3.3)***.
3. Inspect the enclosures for stains and discolorations. If the stain or discoloration is significant, replace the damaged part ***(see Section 7.3.3)***.
4. Insert the key into the lock and verify the key turns 90 degrees to the left to unlock the security door.

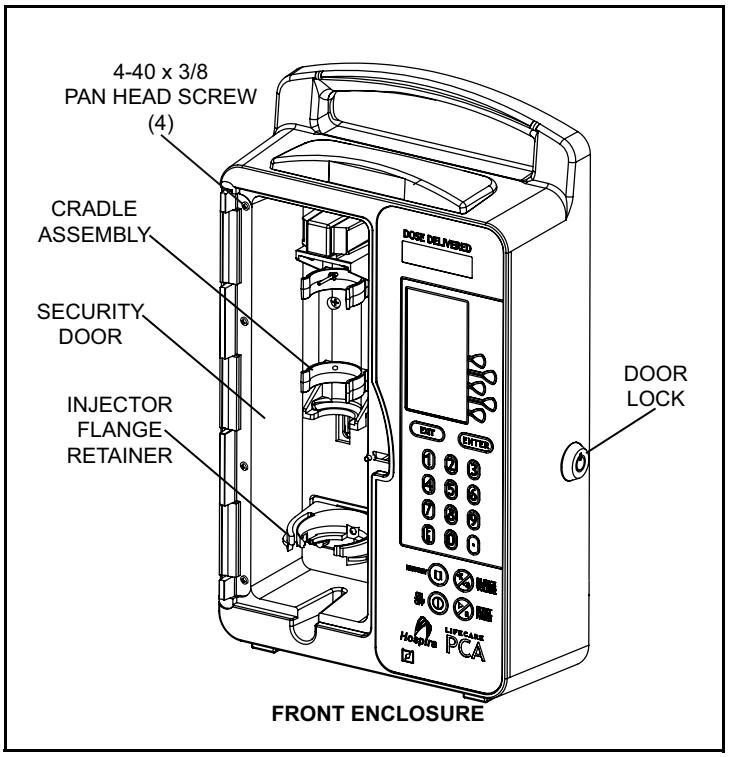
   Note: The Operational Instructions label indicates the **UNLOCK** direction.

5. Open the door and check for the presence of the four screws that attach the hinge, and replace or install any missing screws.
6. Inspect the door and hinge for cracks or damage. Replace the door if it is damaged ***(see Section 7.3.8.1)***.
7. Inspect the cradle assembly for damage and missing screws. Replace the cradle assembly, if damaged, and replace or install any missing screws ***(see Section 7.3.8.4)***.
8. Insert a LifeCare PCA vial into the cradle and ensure a secure fit.

   Note: Move the cradle to its uppermost position before inserting the vial and align the vial barcode against the barcode reader.

9. Insert an injector into the injector flange retainer and ensure a secure fit ***(see Figure 5-2)***.
10. Close the security door and insert the key into the lock. Verify the key turns 90 degrees to the right to lock the security door. Verify that the door aligns with the door latch assembly and that the door is locked.
11. Inspect the rear enclosure for the presence and tightness of the assembly screws, located in the handle. Tighten any loose screws and replace any missing screws.

To test the door, access the **System Tests** in **Biomed Mode** ***(see Section 5.3.4)***.



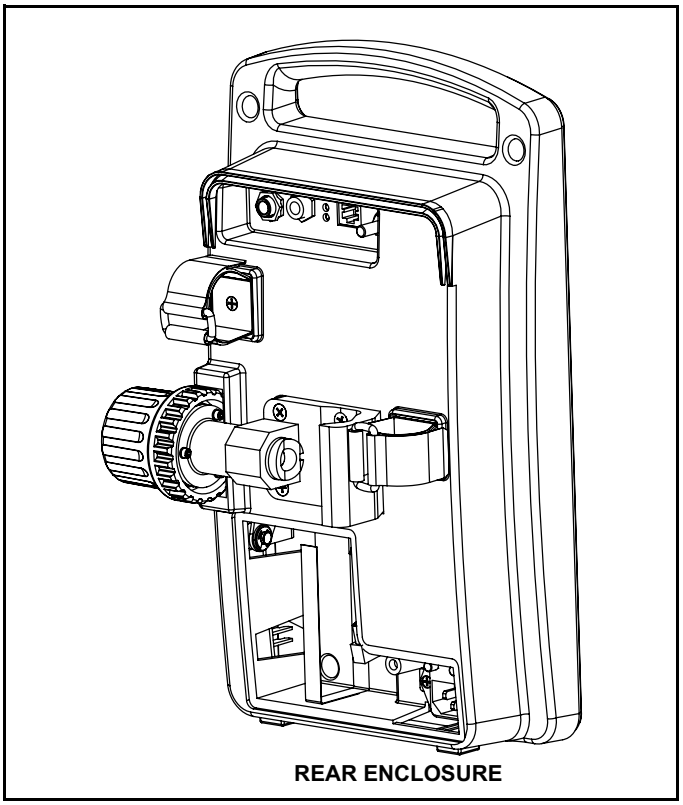


Figure 5-2. Front Enclosure and Rear Enclosure

5.2.4
RUBBER FOOT PAD INSPECTION

Inspect the rubber foot pads at least once every 12 months.

To inspect the rubber foot pads, see ***Figure 5-3***, and proceed as follows:

1. Inspect for missing or loose rubber foot pads, and rubber foot pads that are starting to peel away from their recessed areas in the enclosure. Replace or install as described in ***Section 7.3.4***.

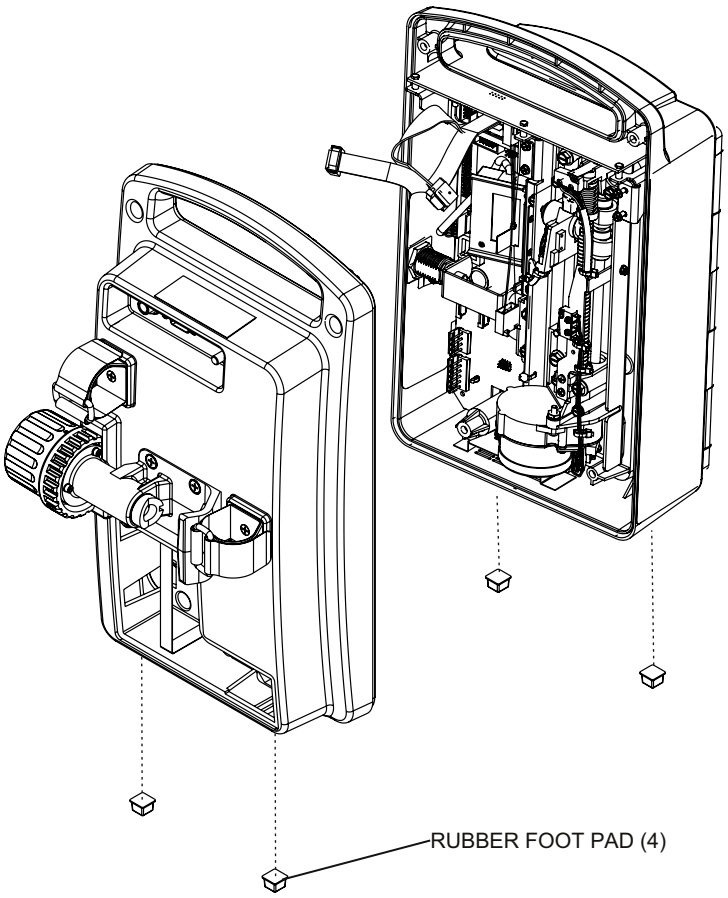


Figure 5-3. Rubber Foot Pads

5.2.5
POLE CLAMP ASSEMBLY INSPECTION AND TEST

Inspect the pole clamp assembly at least once every 12 months.

To inspect the pole clamp, see ***Figure 5-4***, and proceed as follows:

1. Place the infuser on a flat, stable surface.
2. Confirm that the pole clamp assembly is securely attached to the rear enclosure. Tighten the assembly screws if they are loose ***(see Section 7.3.9.2)***.
3. Confirm that the rubber pad is present on the inside surface of the pole clamp assembly. If the pad is missing, replace the assembly ***(see Section 7.3.9.2)***.
4. Insert the LifeCare PCA key and unlock the door for unlocking the pole clamp assembly.
5. Tighten and loosen the pole clamp shaft by rotating the pole clamp knob so that the shaft moves through its entire length. Confirm that the shaft moves smoothly and does not bind along its length. Replace the pole clamp assembly if it binds or is difficult to tighten. If the pole clamp continues to bind after replacement, replace the assembly.
6. Mount the infuser on a Hospira-approved IV pole and fully tighten the clamp. Ensure that the infuser is held firmly and does not slide on the IV pole. If the clamp does not hold the infuser securely, replace the pole clamp assembly.
7. Close and lock the security door. Attempt to turn the pole clamp knob counterclockwise to ensure that the pole clamp locks securely in place when the door is closed and locked.

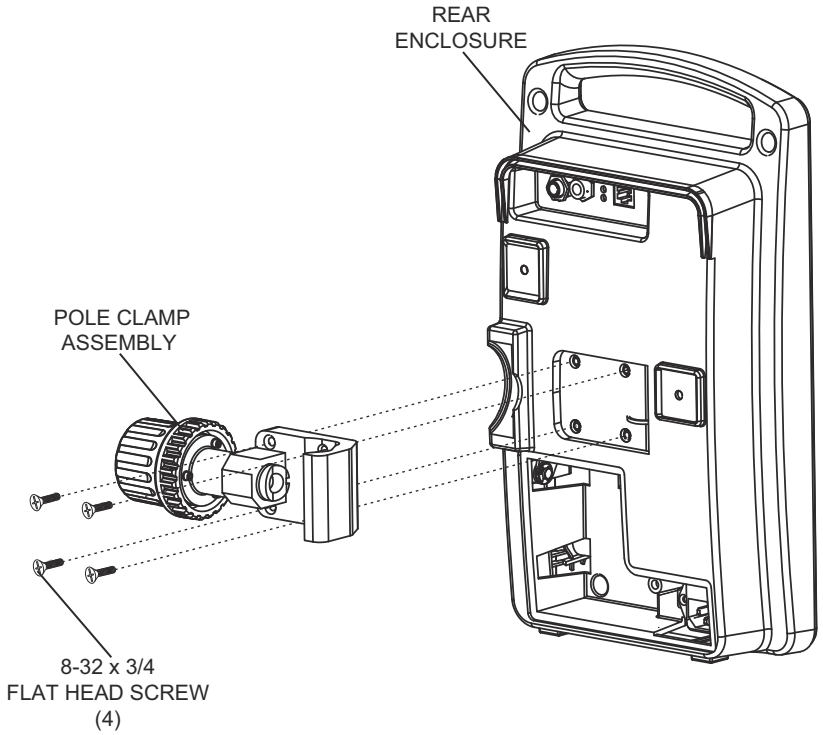


Figure 5-4. Pole Clamp Assembly

5.2.6
KEYPAD, DISPLAYS (LED/LCD), AND INDICATORS INSPECTION

Inspect the keypad, displays (LED/LCD), and indicators at least once every 12 months.

To inspect the keypad, displays (LED/LCD), and indicators, see ***Figure 5-5***, and proceed as follows:

1. Place the infuser on a flat, stable surface.
2. Inspect the keypad for tears, cracks, or other damage. Replace the keypad if damage is observed ***(see Section 7.3.8.2)***.
3. Inspect the keypad for worn or illegible numbers or letters. Replace the keypad if letters or numbers are not readable.
4. Confirm that the keypad has retained its color. Replace the keypad if any of the keys have faded or worn color.
5. Inspect the LED display area for cracks or other damage. Confirm that the display is clean. If the display appears to be damaged, replace the LED display ***(see Section 7.3.8.12)***.
6. Inspect the LCD display area for cracks or other damage. Confirm that the display is clean. If the display appears to be damaged, replace the LCD ***(see Section 7.3.8.13)***.

To test the keypad, displays (LED/LCD), and indicators, access the **System Tests** in **Biomed Mode** ***(see Section 5.3.4)***.

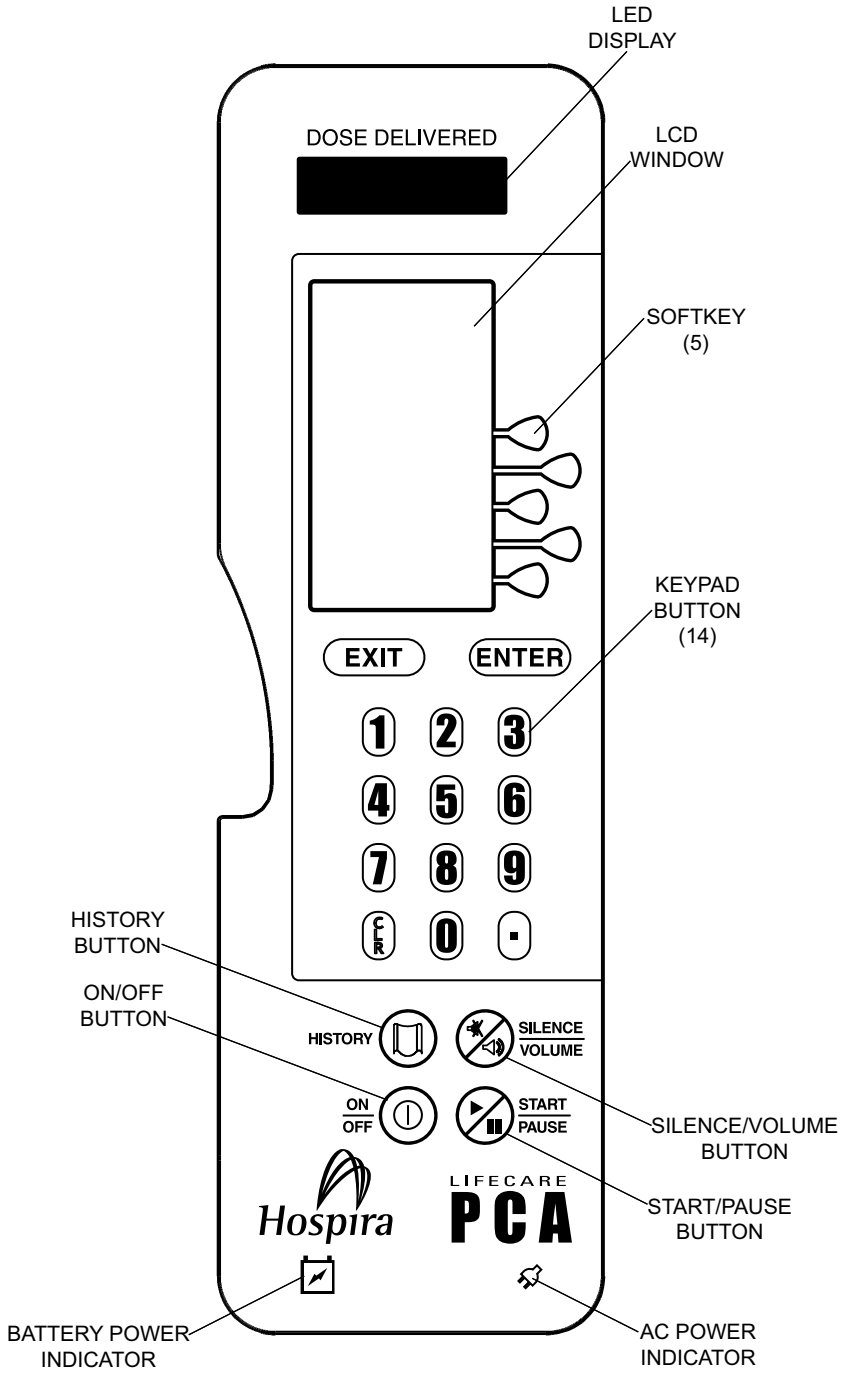


Figure 5-5. Keypad, Displays, and Indicators

5.2.7
PATIENT PENDANT INSPECTION

Inspect the patient pendant at least once every 12 months.

To inspect the patient pendant, see ***Figure 5-6***, and proceed as follows:

1. Unfasten the retaining strap completely, and disconnect the patient pendant from the jack labeled **PATIENT PENDANT** on the back of the infuser.
2. Verify the patient pendant cable is free from cracks, fraying, and torn insulation. If any damage is observed, replace the patient pendant ***(see Section 7.3.7)***.
3. Verify the patient pendant and button is free of damage and evidence of fluid ingress. Press the patient pendant button, and verify the button is not broken. If any damage is observed, replace the patient pendant.
4. Verify the patient pendant port connector pin is present and in good condition. If any damage is observed, replace the patient pendant.
5. Inspect both ends of the patient pendant for any signs of wear or damage. If any damage is observed, replace the patient pendant.
6. Inspect the patient pendant cable fastener for damage. If any damage is observed, replace the fastener.
7. When inspections are completed, connect the patient pendant to the jack on the back of the infuser. Verify the patient pendant is properly engaged/retained.

To test the patient pendant, access the **System Tests** (Keypad Test) in **Biomed Mode** ***(see Section 5.3.4)***.

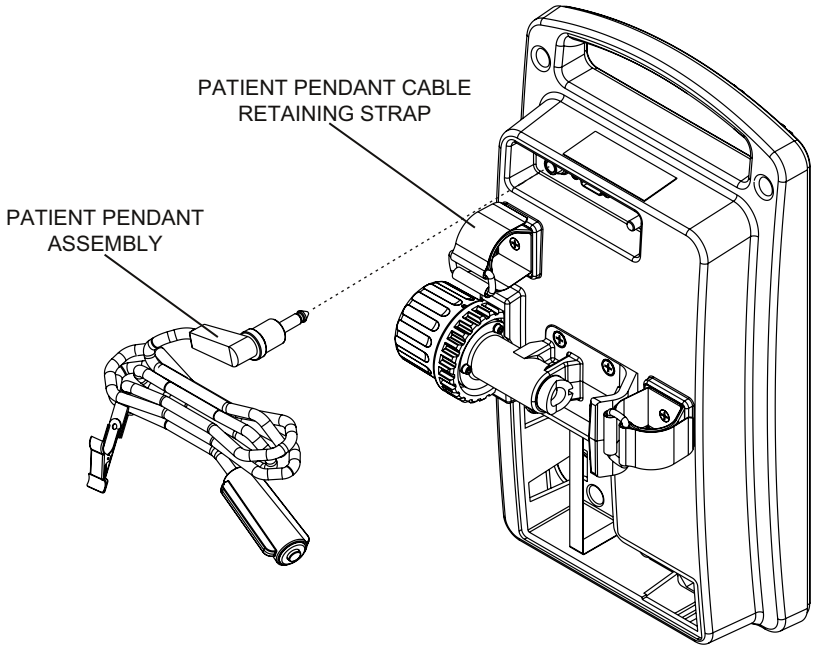


Figure 5-6. Patient Pendant

5.2.8
BARCODE READER WINDOW INSPECTION, TEST, AND CLEANING

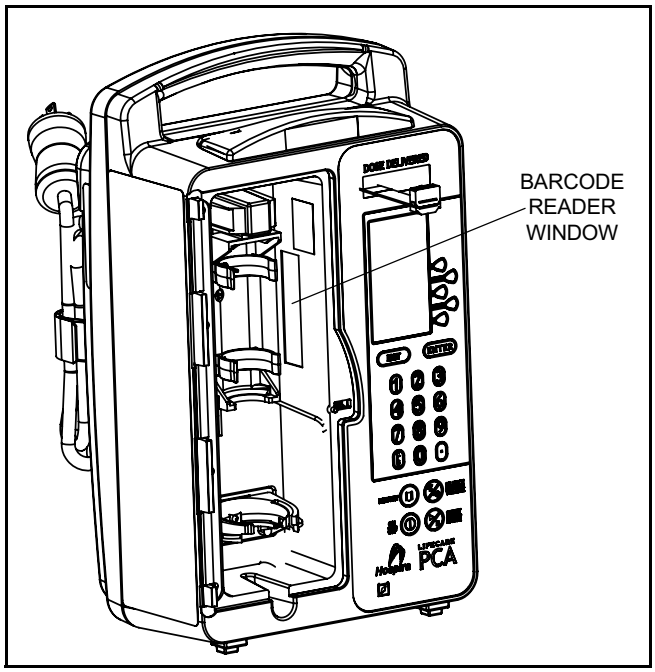
Inspect the barcode reader window and test the barcode reader at least once every 12 months ***(see Section 5.3.4)***.

The recommended cleaner for this procedure is CleanTex CT 811 OpticPad Optic Surface Cleaner.

To inspect and clean the barcode reader window, see ***Figure 5-7***, and proceed as follows:

1. Place the infuser on a flat, stable surface.
2. Ensure the barcode reader assembly is aligned with the barcode reader window. If the barcode reader assembly is loose or misaligned, align it and tighten the screws.
3. Inspect the barcode reader window to verify it is free of damage and there is no evidence of fluid ingress. If the window appears to be damaged, replace the barcode reader window ***(see Section 7.3.8.15)***.
4. Confirm that the barcode reader window is clear. If the window is not clear, follow the cleaning instructions listed below:
   - Use recommended CleanTex CT 811 OpticPad Optic Surface Cleaner or a soft, lint-free cloth moistened with a streak-free optical glass cleaner for cleaning.
   - To avoid fluid ingress, do not spray fluids or cleaning solutions on the barcode reader window, and press lightly on the barcode reader window while cleaning.

To test the barcode reader, access the **System Tests** in **Biomed Mode** ***(see Section 5.3.4)***.



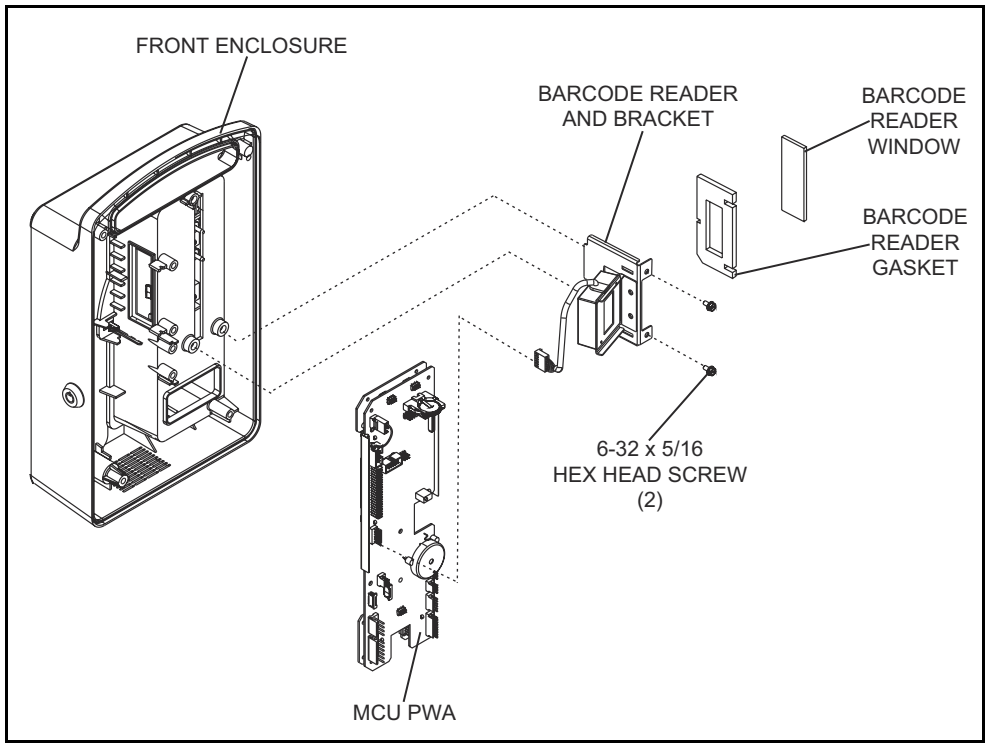


Figure 5-7. Barcode Reader Assembly

5.3
PERFORMANCE VERIFICATION TEST

Note: Perform the PVT at least once every 12 months.

The Performance Verification Test (PVT) consists of the tests described in the following sections. The PVT is designed to assure the infusion system is operating properly, and can also be used for diagnostic purposes during troubleshooting. The PVT should be used for performance verification before an infuser is placed back in service after repair.

Note: Perform the PVT exactly as described in this manual to assure effective and reliable product evaluation information.

If any malfunction is detected as a result of the PVT, see ***Section 6***.

5.3.1
REQUIRED EQUIPMENT

The PVT requires the following equipment and materials (or equivalents):

- Door key
- LifeCare PCA sterile empty vial and injector (List No. 6021)
- LifeCare PCA set (List No. 3559)
- Graduated cylinder, 25 mL, with 0.2 mL graduations (Class A)
- Sterile water or tap water in IV bag/container
- Digital Pressure Meter (DPM), 0 to 50 psi (Fluke™ Biomedical DPM3)
- Digital Multimeter (DMM) (Fluke 187 or equivalent)
- Three-way stopcock, latex-free (List No. 3233-01)
- 18-gauge butterfly needle, latex-free (List No. 4492-01), or 18-gauge blunt cannula
- Safety Analyzer (Fluke Biomedical 232D)

5.3.2
TEST SETUP

WARNING: A PATIENT SHOULD NEVER BE CONNECTED TO THE INFUSER DURING DEVICE TESTING.

To set up the infuser for the PVT, proceed as follows:

1. Using the pole clamp assembly, secure the infuser to an IV pole.

   Note: When the security door is locked, the infuser locks to the pole clamp and prevents its removal without a key.

2. Plug the AC power cord into a grounded, hospital-grade, 120 V_{AC} or 240 V_{AC}, 50 - 60 Hz receptacle.

3. Connect the appropriate Hospira PCA set to a Hospira 30 mL PCA vial/injector.

   CAUTION: Ensure all caps on the vial and the administration set are removed and all clamps are open when priming.

4. Prime the vial and administration set. Hold the vial vertically with the administration set extending from the top. Slowly push down on the injector until all air is cleared from the vial and administration set.

5.3.3
SELF TEST

CAUTION: Do not place the infuser in service if the self test fails.

Conduct all tests with the infuser connected to AC power unless otherwise specified.

Note: If the quality of earth grounding source is in doubt, use battery power.

If an alarm condition occurs during the self test, press **[ON/OFF]** twice. If the alarm condition recurs, note the message and take corrective action ***(see Section 6)***. Repeat the self test. If the alarm condition continues to recur, remove the infuser from service and **contact Hospira**.

To perform the self test, see ***Figure 5-8***, and proceed as follows:

1. Verify the AC plug indicator on the front panel is lit ***(see Figure 5-5)***.

   Note: When the AC plug indicator is off and the battery indicator is flashing, it is an indication that the infuser is operating on low battery power and should be recharged.

2. Unlock and open the security door.

3. Press **[ON/OFF]** to turn on the power. The infuser will perform a self test verifying the integrity of the software, memory, and selected electronic functions.

   Note: If there is insufficient battery power for reliable operation, the infuser will power itself off as soon as possible, without displaying an alarm message.

4. If a battery is not installed, press the **[CONTINUE]** softkey at the **BATTERY NOT INSTALLED** message.

5. Verify **SELF TEST COMPLETE** displays.

6. Press the **[SYSTEM SETTINGS]** softkey, and verify the **SELECT SETTING TO CHANGE** screen appears.
7. Press the **[TIME/DATE]** softkey. The screen displays **WARNING! CHANGING THE DATE OR TIME WILL CLEAR ALL TOTALS!**.
8. Press **[CONTINUE]**.
9. Verify the time and date. To correct the time and date, see ***Section 1.9.4***.
10. Press **[ON/OFF]** to turn off the device.

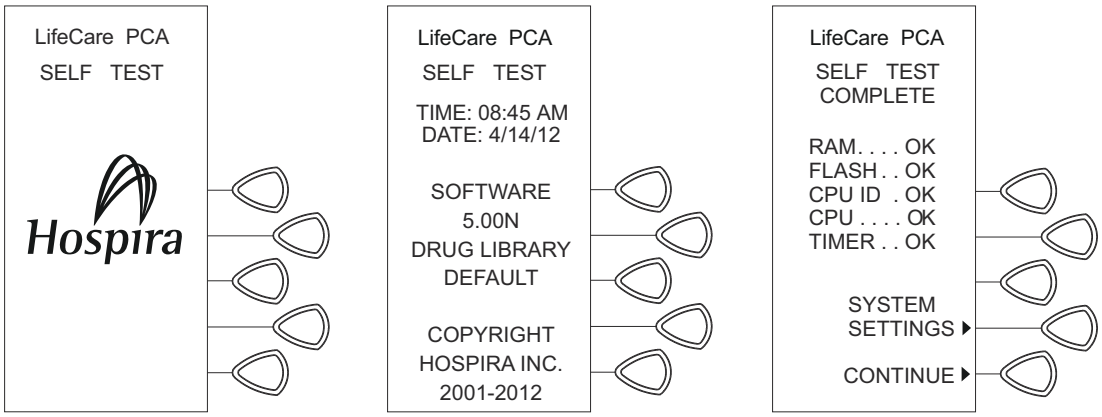


Figure 5-8. LifeCare PCA Self Test Screens

5.3.4
BIOMED MODE TESTS

Table 5-2 provides a list of system tests available in the **Biomed Mode**. Each test displays prompting information on the LCD screen to serve as a guide through the test.

> **Note:** The battery and patient pendant must be connected to the infusion system to complete the Biomed mode tests.

> **Note:** Verify the patient pendant has a label that states the following:
>
> **For use with LifeCare PCA3 pumps**
> **or LifeCare PCA pumps with Hospira MedNet Software ONLY!**

No **Check Printer** alarm will sound if problems are encountered while printing in the Biomed Mode.

To enter the Biomed Mode, proceed as follows:

1. Confirm the AC power indicator on the front panel is lit.
2. Unlock and open the security door.
3. Press and hold **[ENTER]** and **[ON/OFF]** simultaneously.
4. Verify the **BIOMED MODE** screen displays. The **BIOMED MODE** screen includes the current software version and the total elapsed days since new software was downloaded or the device was initialized in Hospira Mode.
5. Verify the infusion system is not connected to a patient and press **[CONTINUE]**.

6. After the power up RAM test is completed, the infuser displays the **Biomed Mode Main Menu** screen. Press the **[MAINTENANCE]** softkey.
7. Press the **[SYSTEM TESTS]** softkey.
8. Press the corresponding softkey to select the test to be performed *(see System Tests in Table 5-2)*. Use the **[NEXT]** and **[PREVIOUS]** softkeys to navigate through the Biomed mode tests and follow the on-screen instructions.
9. When all tests are completed, press **[EXIT]** to return to the **BIOMED MODE** screen, then press **[ON/OFF]** to power off the infuser.

Table 5-2. System Tests

Test	Description
RAM	Test is performed to determine the integrity of the address lines used to select specific memory locations for data access Microcomputer RAM memory is tested
EPROM	Checksum is calculated and compared to a pre-stored and pre-calculated value to assure the operating program residing in EPROM is intact
CPU	Test routine is performed and the test results are verified to assure the microcomputer is executing instructions properly
CLOCK	Real-time clock is tested to verify its accuracy
LCD	Non-displaying test pattern is written to the LCD RAM and compared with a stored pattern to assure that the LCD screen can accurately display data
BACKLIGHT	Display backlight is turned off and on
LED	Pattern of 1s through 9s is displayed by the LEDs to verify operation
INDICATOR	Test verifies battery and AC symbols are turned on and off when the power cord is connected and disconnected
KEYPAD	Stuck touchswitch test determines if any of the touchswitches are permanently shorted Press individual touchswitches to determine if the touchswitch operates and the microcomputer recognizes the correct touchswitch Tests the patient pendant push button
DOOR	Test verifies the microcomputer recognizes when the security door is locked or unlocked
SYRINGE	Test verifies the microcomputer can detect the presence and proper positioning of the vial and injector in the syringe driver mechanism
EMPTY SYRINGE	Test verifies the microcomputer detects an empty syringe
ALARM	Audible alarm signal is generated to verify the alarm circuitry
ROTATION	Motor is rotated a given amount and the shaft sensor signal is checked by the motor control circuitry
BARCODE	Test verifies the barcode reader is functioning

5.3.5
DELIVERY ACCURACY TEST

Note: For an alternate method of performing the delivery accuracy test, see ***Section 5.3.5.1***.

To perform the delivery accuracy test, proceed as follows:

1. Unlock and open the security door.
2. Press **[ON/OFF]** to power on the infuser.
3. With the cradle in the uppermost position, insert a water-filled, primed LifeCare PCA vial and LifeCare PCA set, with an 18-gauge butterfly needle or a blunt cannula, into the cradle.
4. Squeeze the cradle release mechanism and move the cradle down until the vial injector snaps into the bottom bracket.
5. Verify the **SELF TEST COMPLETE** message displays, then press **[CONTINUE]**.

   Note: If no history is stored, proceed to **Step 7**.
6. Verify the **NEW PATIENT?** message displays, then press **[YES]**.
7. The **HISTORY AND RX SETTINGS CLEARED** message displays briefly.
8. Verify the **CONFIRM CUSTOM VIAL TO RX** message displays, then press **[CONFIRM]**.
9. Verify the **PURGE?** message displays, then press **[YES]**.
10. Verify the **PRESS AND HOLD PURGE KEY** message displays. Press and hold the **[PURGE]** softkey until all air is cleared from the LifeCare PCA set, then release the **[PURGE]** softkey.
11. Verify the **PURGE COMPLETE?** message displays. Check for air-in-line and confirm the set is primed, then press **[YES]**.
12. Place the butterfly in a 25 mL graduated cylinder.
13. Verify the **SELECT UNITS OF MEASURE** message displays, then press the **[MILLIGRAMS]** softkey.
14. Verify the **ENTER DRUG CONCENTRATION** message displays. Using the numeric keypad, enter 1, then press **[ENTER]**.
15. Verify the **CONFIRM 1 mg/mL CONCENTRATION TO PHYSICIAN RX** message displays, then press **[CONFIRM]**.
16. Verify the **SET LOADING DOSE?** message displays, then press **[YES]**.
17. Verify the **ENTER LOADING DOSE** message displays. Using the numeric keypad, enter 10 mg, then press **[ENTER]**.
18. Verify the **DELIVER LOADING DOSE NOW?** message displays, then press **[YES]**.
19. Verify the **PRESS START BUTTON TO INFUSE** message displays, then press the **[START/PAUSE]** touchswitch.
20. Verify the **PRESS PAUSE BUTTON TO STOP** message displays, and the infuser is delivering fluid.
21. When the loading dose is complete, the **CHECK SETTINGS** alarm sounds and the infuser displays the **COMPLETE OR CORRECT PUMP SETTING** message. Press **[SILENCE/VOLUME]** to clear.

22. Verify the **SELECT DELIVERY MODE** message displays when the loading dose is completed, then press the **[PREVIOUS]** softkey.
23. Verify the **SET LOADING DOSE?** message displays, then press **[YES]**.
24. Repeat **Step 16** through **Step 21**.
25. Once the second loading dose is completed, verify the infuser delivered 20 mL ± 1 mL.
26. Remove the blunt cannula or needle from the distal end of the LifeCare PCA set.

5.3.5.1
DELIVERY ACCURACY TEST - ALTERNATE METHOD

Note: If the Drug Library will not allow the use of the sterile empty vial, use a vial with a drug concentration of 1 mg/mL, with a minimum of 25 mL of water.

1. Set up the delivery accuracy test as described in ***Section 5.3.5***.
2. Prime the administration set and program the device for multiple deliveries (10 x 2 mL or 4 x 5 mL) to achieve a total volume of 20 mL.
3. Once the multiple deliveries are completed, verify the infuser delivered 20 mL ± 1 mL.

5.3.6
OCCLUSION TEST

Note: To perform the occlusion test as a **stand-alone** test, use setup **Steps 1** through **15** in ***Section 5.3.5***.

Note: Ensure that performance testing for occlusion pressure uses either only new vials or vials that are not stored with water in them.

To perform the occlusion test, proceed as follows:

1. Connect the distal end of the LifeCare PCA set to the DPM through a three-way stopcock. Set the three-way stopcock to air.
2. Verify the **SELECT DELIVERY MODE** message displays when the loading dose is completed, then press the **[PREVIOUS]** softkey.
3. Verify the **SET LOADING DOSE?** message displays, then press **[YES]**.
4. Verify the **ENTER LOADING DOSE** message displays. Using the numeric keypad, enter 10 mg, then press **[ENTER]**.
5. Verify the **DELIVER LOADING DOSE NOW?** message displays, then press **[YES]**.
6. Verify the DPM reads zero.
7. Verify the **PRESS START BUTTON TO INFUSE** message displays, then press **[START/PAUSE]**.
8. Verify fluid discharge at the end of the stopcock, then close the stopcock.
9. Verify the infuser sounds an alarm and displays **OCCLUSION**. Verify the **CHECK LIFECARE PCA SET TO RELIEVE PRESSURE** message appears.

10. Press the **[SILENCE]** touchswitch and verify the DPM reads 15 ± 5 psi.
11. Open the stopcock to clear the occlusion alarm.
12. Remove the vial from the infuser, then press **[ON/OFF]** to power off the infuser.

5.3.7 ELECTRICAL SAFETY TEST

> **Note:** The electrical safety test must be performed in accordance with the instructions contained in the safety analyzer user's guide.

To perform the electrical safety test, see ***Table 5-3***, and proceed as follows:

1. Connect the AC power cord to the safety analyzer.
2. Connect the safety analyzer ground lead to the device equipotential post.
3. Check the leakage current with the safety analyzer. Leakage current must not exceed specifications in ***Table 5-3***.
4. Measure the resistance of the AC connector ground lug with the safety analyzer. Resistance should not exceed specifications in ***Table 5-3***.

   Note: The door hinge is not grounded.

5. Connect the device to AC power and confirm the AC indicator light is lit.

Table 5-3. Electrical Safety Measurements

Measurement	Not to Exceed
Enclosure leakage current (NC - ground intact)	100 µA
Enclosure leakage current (SFC - open neutral or open ground)	300 µA
Earth leakage current (NC - ground intact)	500 µA
Earth leakage current (SFC - open neutral or open ground)	1000 µA
Chassis ground resistance (with cord connected)	0.2 Ω

NC = Normal Condition; SFC = Single-Fault Condition

5.3.8 END OF THE PVT

If any tests fail, see ***Section 6*** or **contact Hospira**.

If all Performance Verification Tests have been successful, proceed as follows:

1. Clear device history.
2. Reset the LifeCare PCA infusion system to the original configuration.
3. Verify the correct time and date.
4. Return the LifeCare PCA infusion system to service.

5.4 CONNECTIVITY CHECK

To check infusion system connectivity, see ***Figure 5-9*** and ***Figure 5-10***, and proceed as follows:

1. To check connectivity in an Ethernet network configuration, verify that a shielded Ethernet cable is plugged into the RJ-45 connector, and confirm the green LED on the rear of the infuser is lit.
2. The wireless symbol is only visible on the **WAITING FOR AUTO PROGRAM** screen. To reach this screen, see the ***Autoprogramming*** section in the ***System Operating Manual***.
3. Once the **WAITING FOR AUTO PROGRAM** screen is reached, verify that the wireless icon is visible ***(see Figure 5-9)***.

If connection problems occur, contact the local IT representative or **contact Hospira**.

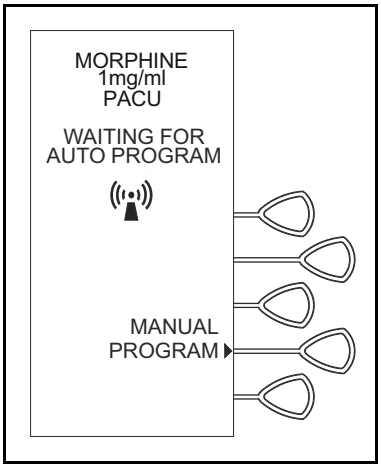


Figure 5-9. Autoprogram Screen

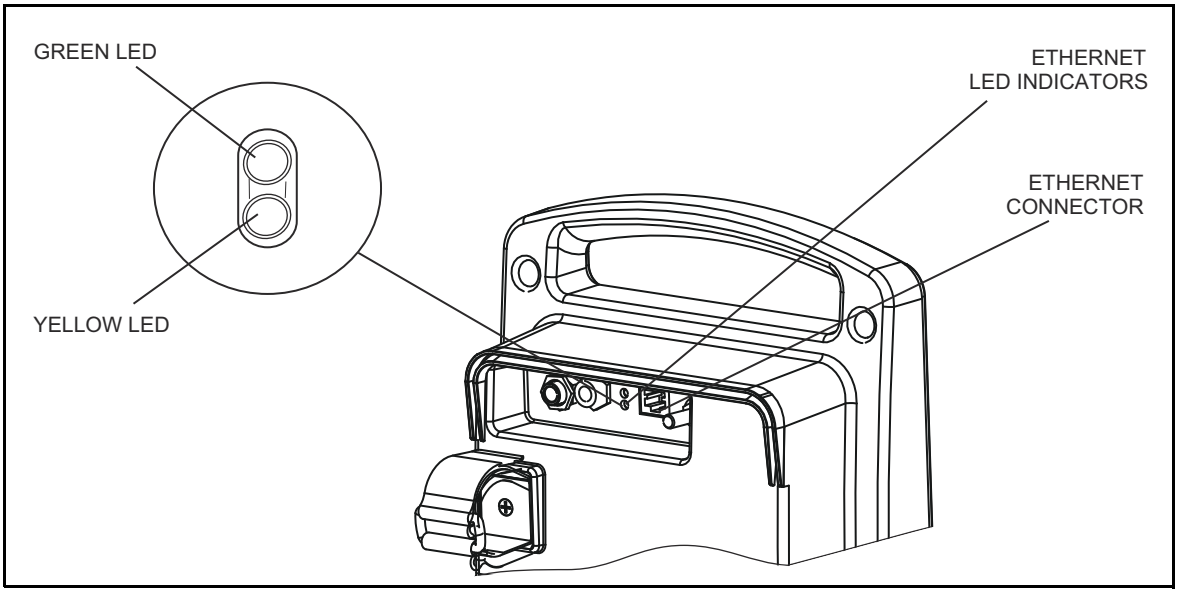


Figure 5-10. Ethernet Connectivity

5.5
BATTERY OPERATION OVERVIEW

The infusion system is intended to operate on battery power on an exception basis only, such as emergency backup or temporary portable operation. Examples of emergency backup include AC power failure or inadvertent disconnection of the AC power cord. An instance of temporary portable operation includes patient transfer from one location to another.

If there is insufficient battery power for reliable operation, the infuser will power itself off as soon as possible, without displaying an alarm message.

When the plug indicator is off and the battery indicator is flashing, it is an indication that the infuser is operating on low battery power and should be recharged.

The infuser should be connected to AC power whenever possible to allow the battery to remain fully charged. The line power indicator turns off and the **BATTERY** legend illuminates when the infuser is operating on battery power. When running on battery power, the backlight extinguishes thirty seconds after the security door is closed and locked.

Factors that most commonly affect battery life are the depth and frequency of discharge and the length of the recharge period. As a general rule, the more often the battery is discharged and recharged, the sooner it will need replacement. The primary cause of damage is leaving the battery in a less than fully charged state for any period of time. Battery damage can occur in a matter of hours and cause a permanent loss of battery capacity. The amount of lost capacity depends on the degree of discharge, the storage temperature, and the length of time the battery was stored in a discharged state.

A permanently damaged battery cannot be recharged to full capacity.

When the battery discharges below the acceptable level while the infuser is operating, the alarm sounds and the battery icon flashes. Although it is not recommended to continue operating the infusion system on battery power at this point, the battery continues providing power until discharged. At this point, the infuser enters the **DEAD BATTERY** mode, and a continuous audible alarm sounds for three minutes, followed by the infuser powering itself off.

⚠ **CAUTION: As soon as the LOW BATTERY alarm occurs, connect the infuser to AC power.**

Recharging occurs any time the infuser is connected to AC power. It is recommended that the infuser be connected to AC power whenever practical to maximize available battery charge during transport or ambulation. The infuser does not have to be on for the battery to recharge. Recharging while the infusion pump is operating is program dependent.

Section 6

TROUBLESHOOTING

This section contains information on technical assistance, Diagnostic Mode, alarm messages and error codes, and troubleshooting procedures.

6.1 TECHNICAL ASSISTANCE

For technical assistance, product return authorization, and to order parts, accessories, or manuals within the United States, **contact Hospira**.

1-800-241-4002

For additional technical assistance, technical training, and product information, visit the website at **www.hospira.com.**

For technical assistance, product return authorization, and to order parts, accessories, or manuals from outside the United States, contact the nearest Hospira sales office.

6.2 DIAGNOSTIC MODE

The **Diagnostic Mode** provides the following features:

- Printout of the event log
- Printout of malfunctions (50 max.)
- Clearing of diagnostic information

For printer set-up instructions, see the ***LifeCare PCA System Operating Manual***.

> **Note:** The **Check Printer** alarm will not sound if problems are encountered while printing in the Biomed mode.

WARNING: A PATIENT SHOULD NEVER BE CONNECTED TO THE INFUSION SYSTEM DURING DIAGNOSTIC MODE OR SERVICE MODE.

To enter **Biomed Mode**, proceed as follows:

1. Confirm the AC power indicator on the front panel is illuminated ***(see Figure 5-5)***.
2. Unlock and open the security door.
3. Press and hold **[ENTER]** and **[ON/OFF]** simultaneously.
4. Verify the **Biomed Mode** screen is displayed. The **Biomed Mode** screen includes the current software version and the total elapsed days since new software was downloaded or the infuser was initialized. Press the **[CONTINUE]** softkey.
5. Connect the infuser to a printer, and press **[CONTINUE]**. After the power up RAM test is completed, the infuser displays the **Biomed Mode** main menu screen.

6. Press the **[DIAGNOSTICS]** softkey and verify the **Diagnostic** menu appears.
7. Press the **[PRT EVENT LOG]** softkey to print the event log.
8. Press the **[PRT MALF. LOG]** softkey to print the malfunction log.
9. Press the **[INIT. PUMP]** softkey to initialize the infuser, then press **[CONTINUE]**.

   Note: Initializing the infuser will clear all data, including stored protocols, and return the device to its default settings.

10. Press **[YES]**. After initializing, the infuser returns to the **Diagnostic** screen.
11. Press **[EXIT]** to return to the **Biomed Mode** screen, or power off, then on, to exit Biomed mode and return the device to normal operation.

6.3
ALARM MESSAGES AND ERROR CODES

Under most alarm conditions, the infuser ceases normal operation, generates an audible alarm, and displays an alarm message or error code on the LCD screen.

There are two types of alarm conditions:

- alarm codes that can be cleared by the operator
- error codes that require qualified service personnel

6.3.1
OPERATIONAL ALARM MESSAGES

Table 6-1 lists infusion system alarm messages that can be cleared by the operator. Also listed in ***Table 6-1*** are the possible causes and corrective actions.

Note: Operational alarm messages are displayed on the LCD screen. Associated error codes are displayed in the alarm history.

Table 6-1. Operational Alarm Messages

Alarm Message	Possible Cause	Corrective Action
No alarm message, pump stalls and cannot be used, or suspends communication with external devices	Null character sent by the CE or the MMU	Power off the device, disconnect from AC power, remove the battery, then restart
Check Settings	Door secured on any screen other than the Press Start to Begin or Setup/Change Menu screen or No key pressed for two minutes	Open the door, check therapy settings, and finish programing therapy settings
Occlusion	Occlusion detected	In setup mode: release and back off cradle assembly In patient mode: open the door, release and back off cradle assembly

Table 6-1. Operational Alarm Messages

Alarm Message	Possible Cause	Corrective Action
Check Syringe	Syringe (vial and injector) is not properly loaded	Properly insert syringe into cradle assembly
Check Vial	Injector is detected and vial is not properly loaded	Properly insert vial into cradle assembly or remove injector
Check Injector	The vial is detected and the injector is not detected	Properly insert injector into cradle assembly or vial injector
Empty Syringe	Empty vial is detected	In setup mode: release and back off cradle assembly In patient mode: open the door, release and back off cradle assembly
Door Open	Door left open or unlocked for more than two minutes	Close and lock the door
Infuser Paused	Infusion stopped by pressing **[START/PAUSE]**	Press **[START/PAUSE]** again, or unlock the door
Low Battery	Operating on battery power with less than 30 minutes of battery life	Connect infuser to AC power Replace battery ***(see Section 7.3.6)*** If problem persists, **contact Hospira**
Battery Fault	**OB**: Open battery **OV**: Over-discharged battery **SH:** Shorted battery	Connect infuser to AC power Replace battery ***(see Section 7.3.6)*** If problem persists, **contact Hospira**
Charger Fault	Battery charger is faulty	Connect infuser to AC power Replace battery ***(see Section 7.3.6)*** If problem persists, **contact Hospira**
Pendant Fault	**O**: Open Faulty connection or pendant Pendant is not secured into its port Pendant button is partially pressed or stuck Using PCA Plus II patient pendant (light gray pendant incompatible) **S**: Short Electrical short in pendant	 Replace the patient pendant or infuser Secure the pendant into the port Release the pendant button Confirm use of PCA patient pendant (blue pendant) Replace pendant

6.3.2
ERROR CODES REQUIRING TECHNICAL SERVICE

Table 6-2 lists infusion system error codes that require technical service. Also listed in ***Table 6-2*** are malfunction descriptions, possible causes, and corrective actions.

Table 6-2. Error Codes Requiring Technical Service

Alarm Code	Malfunction Description	Possible Cause	Corrective Action
170	Interrupt Overlap	Interrupt failure	**Contact Hospira**
171	Invalid Interrupt	Invalid or unused interrupt	
172	Stack Error	RAM error	
173	Task Dead Error	Periodic task or interrupt stopped running	
174	Kernel Error	Kernel failure	
175	Watchdog Error	MCU fails to strobe the watchdog within its timeout period	Verify jumper on pins 5 - 6 of JP1 on MCU PWA If problem persists, **contact Hospira**
176	Cancel Timer Error	Timer message has been unsuccessfully cancelled	**Contact Hospira**
200	Motor Overdelivery Condition	Motor is running faster than expected	
201	Motor Underdelivery Condition	Motor is running slower than expected	
202	Motor Runaway	Motor is running without permission	
203	Excessive Rate Rate/Mode Mismatches	Rate is greater than the maximum rate	
204	Mode	Unexpected mode	
205	Motor Step Time Error	Motor step time out of range	
206	Rate	Unexpected rate	
207	Delivery Volume Error	Volume infused out of range	
310	5-Volt Error	Two readings outside range of 4.7 V - 5.3 V	Replace power supply PWA ***(see Section 7.3.9.4)***
311	Lithium Battery Error	Lithium battery voltage below acceptable minimum value	Verify lithium battery connection Replace lithium battery ***(see Section 7.3.8.12.5)***
313	Battery Current Error	Battery charge current exceeded limit	Verify battery connections Replace battery ***(see Section 7.3.6)***

Table 6-2. Error Codes Requiring Technical Service

Alarm Code	Malfunction Description	Possible Cause	Corrective Action
480	Configuration Data	Failed CRC of pump configuration data	For each malfunction press **[CLEAR]**, then **[ON/OFF]** to power off the infuser, then **[ON/OFF]** to power on the infuser; continue until all malfunctions are cleared Verify lithium battery connections Verify infuser is connected to AC power Replace lithium battery ***(see Section 7.3.8.12.5)*** Replace battery ***(see Section 7.3.6)*** If malfunction cannot be cleared, **contact Hospira**
481	Infusion Data	Failed CRC of infusion data	
482	Program Data	Failed CRC of program data	
483	Flash Checksum Error	Failed checksum at startup or during operation	
484	Stored Protocol Data	Failed CRC of stored protocols	
485	Motor State	Invalid rate or restart; bad states or events in motor software	**Contact Hospira**
486	History Corruption	History data corrupted	
487	Motor Data Error	Failed CRC of motor data	
488	Drug Table Data Error	Failed CRC of drug table data	
489	User Interface Data Error	Failed CRC of saved user interface data	For each malfunction press **[CLEAR]**, then **[ON/OFF]** to power off the infuser, then **[ON/OFF]** to power on the infuser; continue until all malfunctions are cleared Verify lithium battery connections Verify infuser is connected to AC power Replace lithium battery ***(see Section 7.3.8.12.5)*** Replace battery ***(see Section 7.3.6)*** If malfunction cannot be cleared, **contact Hospira**

Table 6-2. Error Codes Requiring Technical Service

Alarm Code	Malfunction Description	Possible Cause	Corrective Action
490	Error Log Data Error	Failed error log checksum	**Contact Hospira**
491	Background Data Error	Inconsistent background data	
492	Switch Data Error	Corrupted switch data	
493	Mirror Data Mismatched	Invalid date and time	
494	UI State Error	User interface state ID out of range	
495	Backlight Data Error	Invalid display data	Replace LCD assembly ***(see Section 7.3.8.12.2)*** If problem persists, **contact Hospira**
496	Vial Manager Data Error	Failed CRC of vial manager data	**Contact Hospira**
497	Power Data Error	Failed CRC of battery charging data	
498	Display Data Error	Invalid display data	Replace LCD assembly ***(see Section 7.3.8.12.2)*** If problem persists, **contact Hospira**
499	Alarm Data Error	Invalid alarm data	**Contact Hospira**
550	Power Down Error	Improper shutdown	
551	Intertask Message Error	Illegal intertask message	
552	Invalid Function Parameter	Invalid parameter data	
553	Invalid Message	Invalid kernel message	
554	Invalid Mode	Invalid user interface mode	
555	Clock Change Error	Invalid date and time during update	
556	Invalid UI State Action	Invalid user interface action code	
557	Invalid Alarm	Illegal alarm message data	
558	Mode Change Error	Illegal mode change message	
559	Invalid UI Stack	User interface stack is corrupted or full	
560	Drug Library Access Error	Invalid auto-programming order or invalid CCA index	Check the drug library against the order

Table 6-2. Error Codes Requiring Technical Service

Alarm Code	Malfunction Description	Possible Cause	Corrective Action
588	Drug Table Data Error	Failed CRC of drug table data	Corrupt data, reload drug library
620	RAM Address Error	Address lines are stuck high, stuck low, or shorted together	**Contact Hospira**
621	Chip ID Error	Register does not contain expected value	
622	Clock RAM Error	Data or address communication errors	
623	External RAM Error	Failed read/write operations on external RAM	
624	LCD Backlight	Backlight current out of range	Verify LCD assembly connections to MCU PWA Replace LCD assembly ***(see Section 7.3.8.12.2)*** If problem persists, **contact Hospira**
625	Battery Icon LED	Battery icon LED current out of range	Verify icon PWA connections to MCU PWA Replace icon PWA ***(see Section 7.3.8.12.4)*** If problem persists, **contact Hospira**
626	Audible Alarm	On or off voltage out of range	**Contact Hospira**
627	LCD Readback Error	Display data does not match RAM data	Replace LCD assembly ***(see Section 7.3.8.12.2)*** If problem persists, **contact Hospira**
628	LED Numeric Display Error	One or more digit segment current out of range	Verify numeric display PWA connections to MCU PWA Replace numeric display PWA ***(see Section 7.3.8.12.3)*** If problem persists, **contact Hospira**
629	Clock Time Error	RTC and MCU out of synchronization	**Contact Hospira**
630	Screw Rotation Error	Motor steps and screw rotations are not in proportion	Lubricate lead screw ***(Section 7.2.6)*** Replace mechanism assembly ***(see Section 7.3.8.14)*** If problem persists, **contact Hospira**

Table 6-2. Error Codes Requiring Technical Service

Alarm Code	Malfunction Description	Possible Cause	Corrective Action
631	LCD Timeout Error	LCD does not acknowledge data within hardware specific-time	Verify LCD assembly connections to MCU PWA Replace LCD assembly ***(see Section 7.3.8.12.2)*** If problem persists, **contact Hospira**
633	Print Error	Failed UART loopback test	Verify printer operation For printer set up instructions, see the ***System Operating Manual*** If problem persists, **contact Hospira**
634	ADC Voltage Reference Error	Analog level out of range	**Contact Hospira**
635	Stuck Key	Key stuck for more than two minutes	Replace keypad ***(see Section 7.3.8.2)*** If problem persists, **contact Hospira**
636	Motor winding excessive current	Motor winding current above 200 mA	Replace mechanism assembly ***(see Section 7.3.8.14)*** If problem persists, **contact Hospira**
637	Motor winding open circuit	Motor winding current below 75 mA	
638	Motor Voltage Error	Motor voltage out of range	
639	Contrast Voltage Error	Contrast voltage out of range	Verify LCD assembly connections to MCU PWA Replace LCD assembly ***(see Section 7.3.8.12.2)*** If the problem persists, **contact Hospira**
640	Internal RAM Error	Failed read/write operations on internal RAM	**Contact Hospira**
641	Occlusion Switch Error	Defective occlusion sensor	Adjust occlusion alarm switch ***(see Section 7.2.5.2)*** Replace mechanism assembly ***(see Section 7.3.8.14)*** If problem persists, **contact Hospira**
642	Empty Syringe Switch Error	Defective empty syringe sensor	Replace mechanism assembly ***(see Section 7.3.8.14)*** If problem persists, **contact Hospira**

Table 6-2. Error Codes Requiring Technical Service			
Alarm Code	**Malfunction Description**	**Possible Cause**	**Corrective Action**
643	Injector Switch Error	Defective injector sensor	Adjust injector switch ***(see Section 7.2.3)*** Replace mechanism assembly ***(see Section 7.3.8.14)*** If problem persists, **contact Hospira**
644	Watchdog Timer Error	Watchdog failure	Verify jumper on pins 5 - 6 of JP1 on MCU PWA If problem persists, **contact Hospira**
645	Barcode Reader Error	Three consecutive attempts to read the barcode have failed	Replace barcode reader ***(see Section 7.3.8.15)*** If problem persists, **contact Hospira**
646	UART Loopback Test Error	Serial communication chip failure	**Contact Hospira**

6.4
TROUBLESHOOTING PROCEDURES

This section details recommended procedures for problems not associated with malfunction alarms.

Before performing any troubleshooting procedure, turn off the infuser, then on.

Allow the self test to complete and proceed as follows:

1. If a malfunction exists, carefully inspect the infusion system for damage.
2. If an infusion system inspection has not disclosed a malfunction, perform the PVT in ***Section 5.3***. See ***Table 6-3*** for PVT section reference, probable cause, and corrective actions.
3. If, after completing Steps 1 and 2, a malfunction has not been located, or if the infuser persistently fails, **contact Hospira**.

Table 6-3. Troubleshooting with the PVT

Test Failure	Probable Cause	Corrective Action
Self Test *(Section 5.3.3)*	Self test failure	Power off infuser, then power on If error recurs, contact Hospira
Biomed Mode Tests *(Section 5.3.4)*	Defective MCU PWA	**Contact Hospira**
IN RAM	Defective MCU PWA	
RAM	Defective MCU RAM	
ROM	Defective EPROM	
CPU	Defective CPU	
CLOCK	Defective RTC	
LCD	Defective LCD assembly	Verify LCD assembly connection to MCU PWA Replace LCD assembly *(Section 7.3.8.12.2)*
	Defective MCU PWA	**Contact Hospira**
BACKLIGHT	Defective LCD assembly	Verify LCD assembly connection to MCU PWA Replace LCD assembly *(Section 7.3.8.12.2)*
	Defective MCU PWA	**Contact Hospira**
LED	Defective numeric display PWA	Verify numeric display PWA connection to MCU PWA Replace numeric display PWA *(Section 7.3.8.12.3)*
	Defective MCU PWA	**Contact Hospira**
INDICATOR	Defective icon display PWA	Verify icon display connection to MCU PWA Replace icon display PWA *(Section 7.3.8.12.4)*
	Defective MCU PWA	**Contact Hospira**
KEYPAD	Defective keypad	Replace keypad *(Section 7.3.8.2)*
	Defective MCU PWA	**Contact Hospira**
DOOR	Defective door lock assembly	Replace door lock assembly *(Section 7.3.8.7)*
	Defective MCU PWA	**Contact Hospira**

Table 6-3. Troubleshooting with the PVT

Test Failure	Probable Cause	Corrective Action
SYRINGE	Defective mechanism assembly	Adjust vial sensor switch *(Section 7.2.4)* Replace mechanism assembly *(Section 7.3.8.14)*
	Defective MCU PWA	**Contact Hospira**
EMPTY VIAL	Defective mechanism assembly	Adjust vial sensor switch *(Section 7.2.4)* Replace mechanism assembly *(Section 7.3.8.14)*
	Defective MCU PWA	**Contact Hospira**
ALARM	Defective MCU PWA	**Contact Hospira**
ROTATION	Defective mechanism assembly	Replace mechanism assembly *(Section 7.3.8.14)*
PATIENT PENDANT ASSEMBLY	Defective patient pendant assembly	Replace patient pendant assembly *(Section 7.3.7)* Verify that replacement patient pendant is color-coded blue
Delivery Accuracy Test *(Section 5.3.5)*	LifeCare PCA set not properly primed	Re-prime set and check clamps
	Defective mechanism assembly	Replace mechanism assembly *(Section 7.3.8.14)*
Occlusion Test *(Section 5.3.6)*	Set not properly primed or installed	Prime set
	Defective mechanism	Adjust occlusion alarm switch *(Section 7.2.5)* Replace mechanism assembly *(Section 7.3.8.14)*
Electrical Safety Test *(Section 5.3.7)*	Defective AC power cord	Replace AC power cord *(Section 7.3.5)*

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Section 7

REPLACEABLE PARTS AND REPAIRS

This section contains adjustment procedures, safety and equipment precautions, required tools and materials, and step-by-step procedures for replacing parts in the infuser.

Unless otherwise stated, always perform the PVT after a replacement procedure.

Figures are rendered as graphic representations to approximate actual product. Therefore, figures may not exactly reflect the product.

7.1 REPLACEABLE PARTS

Replaceable parts for the infusion system are itemized in the Illustrated Parts Breakdown (IPB) and are identified in ***Figure 9-1***. ***Table 9-2*** identifies each part by an index number that correlates to ***Figure 9-1***.

To view the online replacement parts list, visit the website at **www.hospiraparts.com**.

7.2 ADJUSTMENT PROCEDURES

Before opening the front enclosure of the infuser, take all necessary precautions for working on high-voltage equipment.

WARNING: EXPLOSION HAZARD EXISTS IF THE INFUSER IS SERVICED IN THE PRESENCE OF FLAMMABLE SUBSTANCES.

WARNING: UNLESS OTHERWISE INDICATED, DISCONNECT THE INFUSER FROM AC POWER BEFORE PERFORMING ADJUSTMENT OR REPLACEMENT PROCEDURES.

CAUTION: Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected workstation. Store PWAs in antistatic bags before placing them on any surface.

Unless otherwise indicated, the following procedures require an empty syringe to be installed in the cradle.

7.2.1
REQUIRED TOOLS AND MATERIALS

The following tools and materials, or equivalents, are required for the adjustment procedures in this section. In addition, the beginning of each procedure lists tools and materials recommended for that specific procedure.

- Set of standard and metric nutdrivers
- Set of Phillips™ screwdrivers
- X-acto™ knife
- Digital pressure meter (Fluke Biomedical DPM3)
- Red GLPT insulating varnish
- Water-filled syringe
- LifeCare PCA vial
- Three-way stopcock
- LifeCare PCA IV administration set (List No. 3559-04)
- Grease (Braycote™ 804)
- Isopropyl alcohol
- Lint-free cloth
- Cotton swabs
- Small brush

7.2.2
SEPARATING THE FRONT AND REAR ENCLOSURES

The front and rear enclosures must be separated before performing any adjustment procedure.

The recommended tool for this procedure is a No. 2 Phillips screwdriver.

To separate the front and rear enclosures, see ***Figure 7-1*** and ***Figure 7-6***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Place the infuser face down on a soft surface with the security door open approximately 270 degrees.
3. Using the Phillips screwdriver, remove the 6-32 screw that attaches the battery door to the rear of the infuser, and remove the door ***(see Figure 7-6)***.
4. Disconnect the AC power cord by grasping the plug. Do not pull on the power cord.
5. Separate the battery connector assembly from the battery and remove the battery.
6. Using the Phillips screwdriver, remove the 6-32 screws from each corner of the rear enclosure.
7. Raise the rear enclosure approximately 40 degrees.
8. Disconnect connector P3 from the I/O PWA and connectors P9, P14, and P17 from the MCU PWA.
9. Remove the rear enclosure assembly.

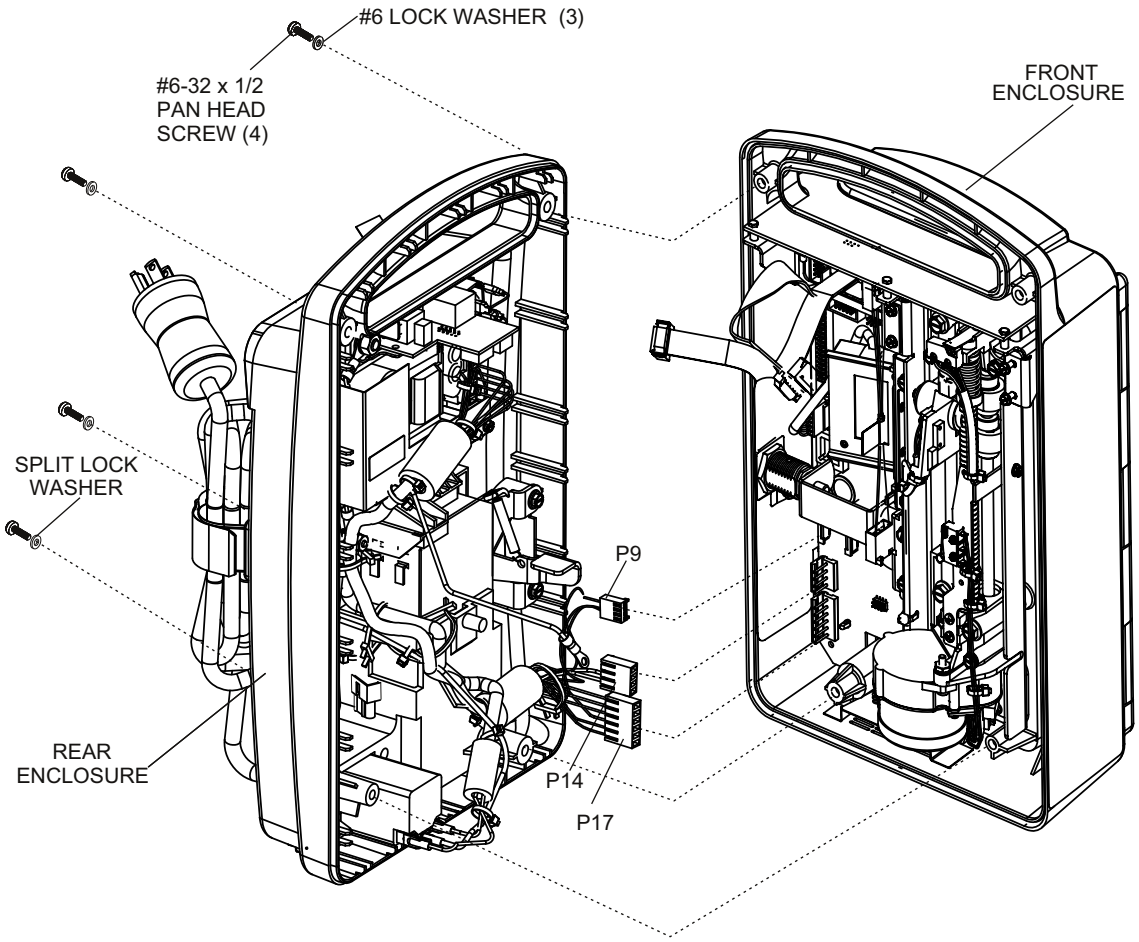

Figure 7-1. Separating the Front and Rear Enclosure Assemblies

7.2.3
INJECTOR SENSOR SWITCH ADJUSTMENT

The recommended tools and materials for this procedure are a No. 0 Phillips screwdriver and red GLPT insulating varnish.

To adjust the injector sensor switch, see ***Figure 7-2***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Using the Phillips screwdriver, loosen the two switch mounting screws until the switch holder can be easily moved. Do not loosen the screws so much that the switch bracket rocks from side to side.
4. Position the switch bracket parallel to the surface and 1/32 inch from the front enclosure, then tighten the screws.
5. Apply red GLPT insulating varnish to the screw heads.

6. Reassemble the infuser in the exact reverse order of disassembly.
7. Close and lock the security door.
8. Connect the infuser to AC power.

To verify successful adjustment of the injector sensor switch, perform the PVT in ***Section 5.3***.

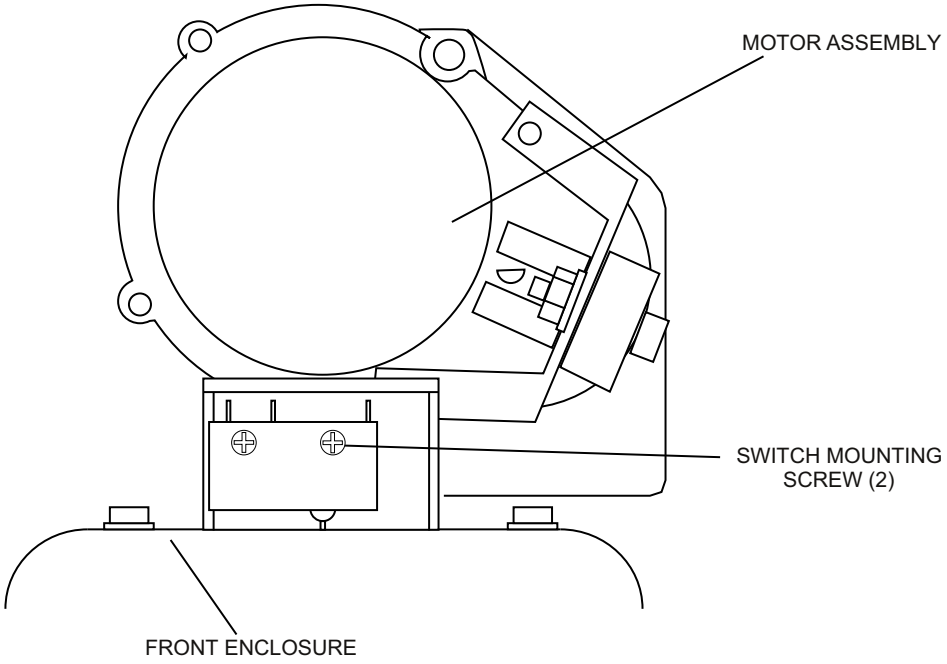

Figure 7-2. Injector Sensor Switch

7.2.4
VIAL SENSOR SWITCH ADJUSTMENT

The recommended tools and materials for this procedure are a No. 0 Phillips screwdriver and red GLPT insulating varnish.

To adjust the vial sensor switch, see ***Figure 7-3***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Using the Phillips screwdriver, loosen the two vial sensor switch adjustment screws until the switch holder can be easily moved. Do not loosen the screws so much that the switch bracket rocks from side to side.
4. Place the switch bracket upright. Move the switch up slowly until it clicks off, then move the switch down slowly until it clicks on.
5. Move the switch down approximately 1/16 inch to verify the switch detects a vial. Tighten the screws while keeping the switch bracket level.
6. Apply red GLPT insulating varnish to the screw heads.

7. Reassemble the infuser in the exact reverse order of disassembly.
8. Close and lock the security door.
9. Connect the infuser to AC power.

To verify successful adjustment of the vial sensor switch, perform the PVT in ***Section 5.3***.

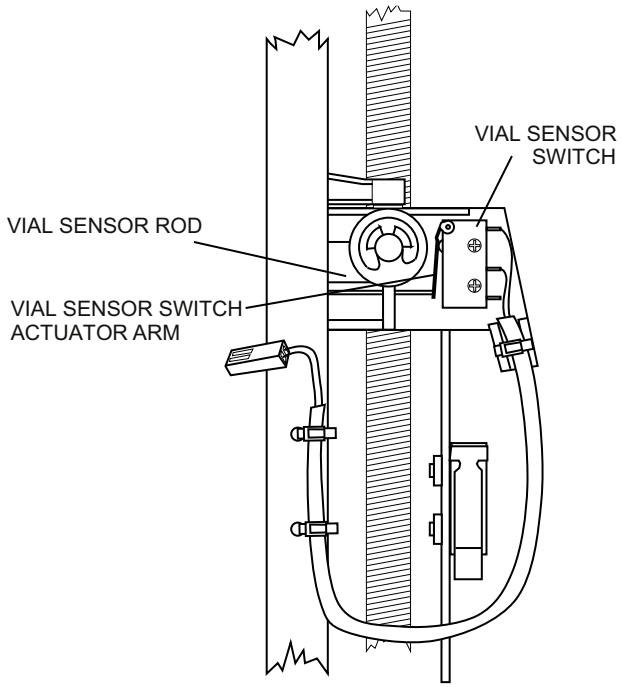

Figure 7-3. Vial Sensor Switch

7.2.5 OCCLUSION ALARM SWITCH TEST AND ADJUSTMENT

The recommended tools and materials for the following procedures are a No. 0 Phillips screwdriver, water-filled syringe, DPM, three-way stopcock, and an IV administration set.

7.2.5.1 OCCLUSION ALARM SWITCH TEST

To perform the occlusion alarm switch test, see ***Figure 7-4***, and proceed as follows:

1. Using the three-way stopcock, attach the DPM to the end of the patient line.
2. Install the water-filled syringe and IV administration set into the infuser.
3. Verify the self test has completed, then press **[CONTINUE]**.
4. Verify the **CUSTOM VIAL** message is displayed, then press **[CONFIRM]**.
5. Verify the **CLEAR HISTORY** message is displayed, then press **[YES]**.

6. Verify the **CONFIRM CLEAR HISTORY** message is displayed, then press **[CONFIRM]**.
7. Verify the **PURGE?** message is displayed, then press **[YES]**.
8. Verify the **DISCONNECT SET FROM PATIENT/PRESS AND HOLD PURGE KEY** message is displayed.
9. Press and hold the **[PURGE]** softkey until flow is seen at the three-way stopcock, then release the **[PURGE]** softkey.
10. Verify the **PURGE COMPLETE?** message is displayed. Check for air-in-line and assure the set is primed, then press **[YES]**.

    Note: Disregard the **RECONNECT SET TO PATIENT** message.

11. Verify the **SELECT UNITS OF MEASURE** message is displayed, then press **[MILLIGRAMS]**.
12. Verify the **ENTER DRUG CONCENTRATION** message is displayed.
13. Press **[1]**, then press **[ENTER]**.
14. Verify the **CONFIRM CONCENTRATION** message is displayed, then press **[CONFIRM]**.
15. Verify the **SET LOADING DOSE** message is displayed, then press **[YES]**.
16. Verify the **ENTER LOADING DOSE** message is displayed.
17. Press **[1]** and **[0]**, then press **[ENTER]**.
18. Verify the **PRESS START BUTTON TO INFUSE** message is displayed, then press **[START/PAUSE]**.
19. Verify the **PRESS PAUSE BUTTON TO STOP** message is displayed.
20. Verify the infuser sounds an alarm, displays **OCCLUSION**, and the **CHECK LIFECARE PCA SET TO RELIEVE PRESSURE** message appears.
21. Press **[SILENCE]** and verify the DPM reads 15 ± 5 psi. If the reading is not 15 ± 5 psi, perform the occlusion alarm adjustment procedure in ***Section 7.2.5.2***.
22. Open the stopcock to clear the occlusion alarm.
23. Remove the vial from the infuser.

If the reading is between the specified parameters, perform the PVT in ***Section 5.3***.

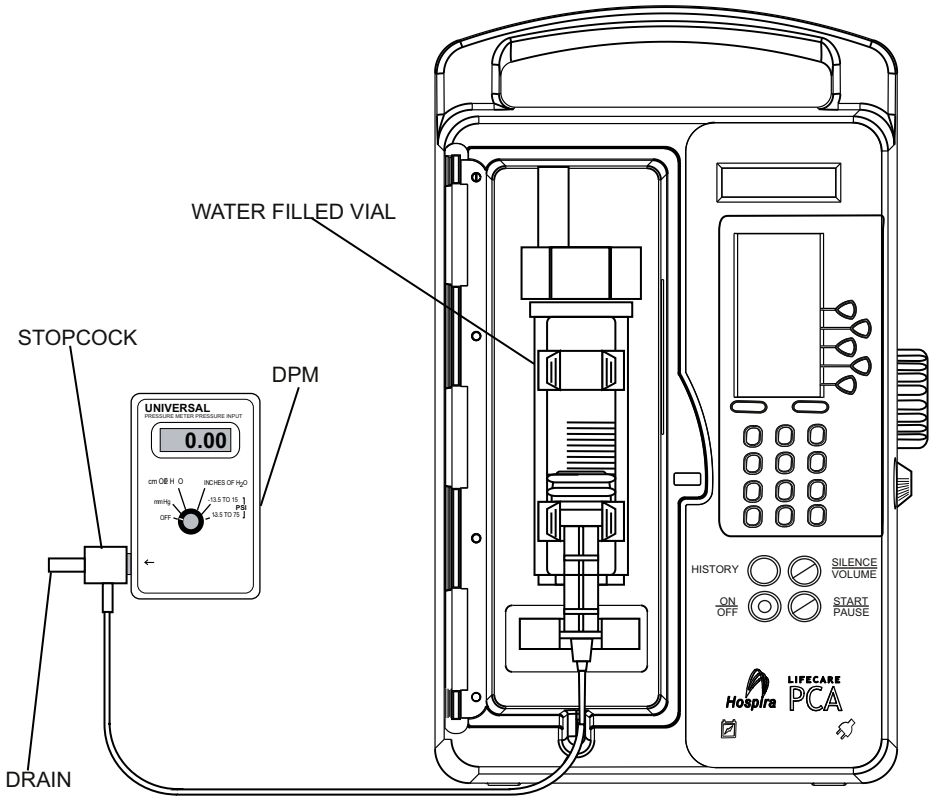

Figure 7-4. Occlusion Alarm Test Setup

7.2.5.2

OCCLUSION ALARM SWITCH AND PRESSURE ADJUSTMENT

To adjust the occlusion alarm switch and pressure, see ***Figure 7-5***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Remove the CE PWA as described in ***Section 7.3.8.9***.
4. Examine the position of the occlusion alarm switch. If the leaf spring is holding the occlusion switch closed, proceed to Step 6.
5. If the leaf spring is not holding the occlusion switch closed, check for the following three possibilities:
   - The leaf spring may be damaged or bent. Replace it if necessary.
   - The 2-24 screw holding the leaf spring to the mechanism top support may be loose. If the screw is loose, tighten it using the Phillips screwdriver. Adjust the screw until the leaf spring is holding the occlusion switch closed.
   - The flat washer located under the leaf spring may be missing. Remove the leaf spring and verify the flat washer is in place.
6. If, after investigating the possibilities in Step 5, the leaf spring cannot be kept in contact with the occlusion alarm switch, **contact Hospira**.

7. Reinstall the CE PWA and connect the infuser to AC power.
8. Connect the cables from the rear enclosure assembly to the MCU PWA to allow the infuser to operate with the enclosure open ***(see Figure 7-1)***. Support the front enclosure assembly to keep it upright for the adjustment procedure.
9. Install the water-filled syringe, and connect the IV administration set, DPM, and stopcock. Open the stopcock valve to air.
10. Perform the occlusion alarm switch test as described in ***Section 7.2.5.1***.
11. If the occlusion alarm sounds before the pressure reaches 10 psi, relieve the fluid pressure by opening the stopcock valve. Loosen the set screw on the thumb nut and turn the thumb nut clockwise to tighten, and repeat Step 4.
12. If the occlusion alarm does not sound at or before 20 psi, relieve the fluid pressure by opening the stopcock valve. Loosen the set screw on the thumb nut and turn the thumb nut counter clockwise to loosen, and repeat Step 4 and Step 5.
13. When the infuser occludes at between 10 and 20 psi, retighten the set screw on the thumb nut.
14. Reassemble the infuser in the exact reverse order of disassembly.

Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

To verify successful adjustment of the occlusion alarm switch and pressure, perform the PVT in ***Section 5.3***.

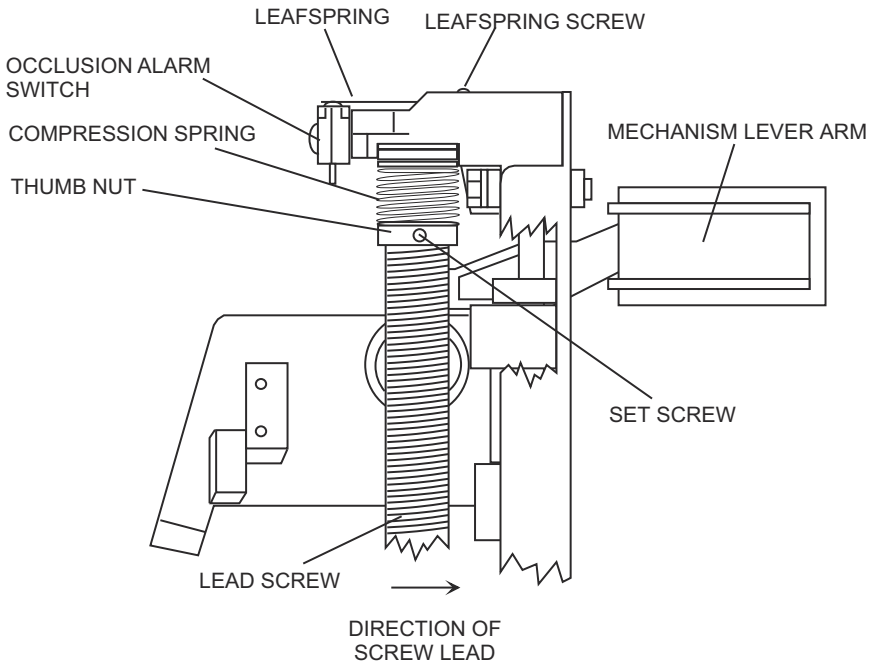

Figure 7-5. Occlusion Alarm Pressure Adjustment

7.2.6
LEAD SCREW LUBRICATION

The recommended tools and materials for this procedure are isopropyl alcohol, cotton swabs or a small brush, and Braycote grease.

To lubricate the lead screw, see ***Figure 7-5***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Using isopropyl alcohol and cotton swabs or a small brush, remove all grease and residue from the lead screw.

   Note: Ensure that all residual lubricant is removed.

4. Apply a thin coating of grease and work it into the threads along the length of the shaft. Do not fill the threads. Move the slide clamp as necessary to clean and lubricate the length of the lead screw.

To verify successful lead screw lubrication, perform the PVT in ***Section 5.3***.

7.3
REPLACEMENT PROCEDURES

This section contains safety and equipment precautions, required tools and materials, and step-by-step procedures for replacing parts in the infuser. Unless otherwise stated, always perform the PVT after a replacement procedure.

> **Note:** Figures are rendered as graphic representations to approximate actual product. Therefore, figures may not exactly reflect the product.

7.3.1
SAFETY AND EQUIPMENT PRECAUTIONS

Before opening the front enclosure of the infuser, take all necessary precautions for working on high-voltage equipment.

WARNING: EXPLOSION HAZARD EXISTS IF THE INFUSER IS SERVICED IN THE PRESENCE OF FLAMMABLE SUBSTANCES.

WARNING: UNLESS OTHERWISE INDICATED, DISCONNECT THE INFUSER FROM AC POWER BEFORE PERFORMING ADJUSTMENT OR REPLACEMENT PROCEDURES.

CAUTION: Use proper ESD grounding techniques when handling components. Wear an antistatic wrist strap and use an ESD-protected workstation. Store PWAs in antistatic bags before placing them on any surface.

7.3.2
REQUIRED TOOLS AND MATERIALS

The following tools and materials, or equivalents, are required for the replacement procedures in this section. In addition, the beginning of each procedure lists tools and materials recommended for that specific procedure.

- Set of standard and metric nutdrivers
- Set of flat blade screwdrivers
- Set of Phillips screwdrivers
- Set of box wrenches
- Set of open end wrenches
- Needle nose pliers
- Diagonal cutters
- X-acto knife
- Red GLPT insulating varnish
- Permanent marker
- Isopropyl alcohol
- Lint-free cloth

7.3.3
FRONT AND REAR ENCLOSURE REPLACEMENT

The recommended tool for this procedure is a No. 2 Phillips screwdriver.

Replacement parts for this procedure are:

Enclosure, Front
Enclosure, Rear
Screw, 6-32 x 1/2, Pan Head, Phillips
Washer, Lock, #6

To replace the front and rear enclosures, see ***Figure 7-1***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. To replace the front enclosure, remove the specific components described in ***Section 7.3.8***.
4. To replace the rear enclosure, remove the specific components described in ***Section 7.3.9***.
5. Reassemble the replacement front or rear enclosure assembly ***(see Section 7.3.8*** or ***Section 7.3.9)***.

   Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

6. Join the front enclosure and rear enclosure in the exact reverse order of separation.

To verify successful replacement of the front and rear enclosures, perform the PVT in ***Section 5.3***.

7.3.4
RUBBER FOOT PAD REPLACEMENT

Recommended tools and materials for this procedure are an X-acto knife and isopropyl alcohol.

The replacement part for this procedure is:

Pad, Rubber Foot

To replace the rubber foot pad, see ***Figure 7-6***, and proceed as follows:

1. Disconnect the infuser from AC power, and place the device on its side.
2. Using the X-acto knife, remove the rubber foot pad and scrape the enclosure recess to remove adhesive residue. Each adhesive-backed rubber foot pad is bonded in its recess. Do not damage the recess.
3. Using isopropyl alcohol, clean any adhesive residue from the enclosure recess.
4. Remove the protective backing from the self-adhesive surface of the replacement foot pad and press the pad in place.
5. After approximately five minutes, verify the foot pad is secure.

Replacement of a rubber foot pad is routine maintenance and no verification procedure is normally required. However, if the infuser may have been damaged during this procedure, perform the PVT in ***Section 5.3***.

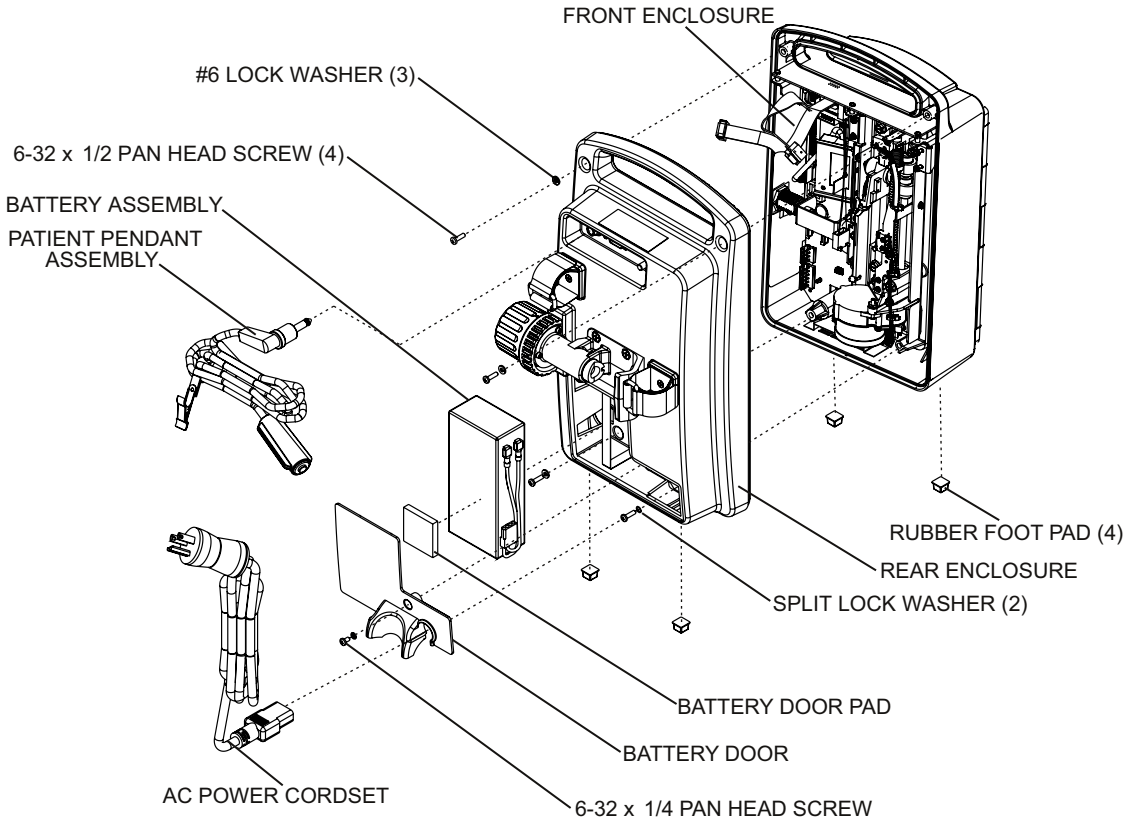

Figure 7-6. Battery Assembly, AC Power Cord, and Patient Pendant Assembly

7.3.5
AC POWER CORD REPLACEMENT

The recommended tool for this procedure is a No. 2 Phillips screwdriver.

The replacement part for this procedure is:

Cordset, AC Power, Hospital Grade

To replace the AC power cord, see ***Figure 7-6***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Using the Phillips screwdriver, remove the 6-32 screw that attaches the battery door to the rear of the infuser.
3. Disconnect the defective AC power cord by grasping the plug. Do not pull on the cord.
4. Replace the AC power cord by plugging it into the infuser's AC power receptacle.
5. Reinstall the battery door with the screw that was removed in Step 2.
6. Connect the infuser to AC power and confirm the AC indicator is lit.

To verify successful AC power cord replacement, perform the Electrical Safety Test in ***Section 5.3.7***.

If the infuser may have been damaged during this procedure, perform the PVT in ***Section 5.3***.

7.3.6
BATTERY, BATTERY DOOR, DOOR PAD, AND BATTERY STRAP REPLACEMENT

Recommended tools and materials for this procedure are:

- No.1 Phillips screwdriver
- No. 2 Phillips screwdriver
- Long needle nose pliers
- Battery cable connector tool (P/N 519-89318-001), or equivalent
- Isopropyl alcohol
- Lint-free cloth

Replacement parts for this procedure are:

Assembly, Battery, with Wire Harness
Door, Battery
Pad, Battery Door
Strap, Battery
Screw, 6-32 x 1/4, Pan Head, Phillips
Screw, 4-24 x 3/8, Thread Cutting, Phillips
Washer, Flat, #6

To replace the battery, battery door, and battery door pad, see ***Figure 7-6*** and ***Figure 7-14***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Using the No. 2 Phillips screwdriver, remove the 6-32 screw that attaches the battery door to the rear of the infuser and remove the battery door.
3. Inspect the battery door and door pad for damage. If the pad is defective, remove it from the door and clean the door with isopropyl alcohol. Dry the battery door thoroughly, and install the replacement pad on the battery door.
4. Inspect the battery strap for damage ***(see Figure 7-14)***. If the battery strap is defective, remove the 4-24 thread cutting screw and the washer securing the battery strap to the rear enclosure.
5. Install the replacement battery strap in the exact reverse order of removal.
6. Pull the battery wire harness and cable outside the enclosure. Disconnect the battery assembly from the infuser. Pull up on the battery strap and remove the battery from the enclosure.
7. Using the needle nose pliers, remove the wire harness connectors from the battery terminals.

   Note: Dispose of the battery in accordance with local battery disposal practices.

8. Using the battery cable connector tool, install the wire harness connectors onto the terminals of the replacement battery. Confirm the red wire is installed on the positive **(+)** terminal next to the red marker on top of the battery, and the black wire is installed on the negative **(-)** terminal.

   ⚠ **CAUTION: Do not allow the terminals to come into contact with each other.**

   Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

9. Connect the replacement battery to the battery connector. Confirm the connection is tight. The cable connectors are keyed so that cables cannot be connected incorrectly.

   Note: Install the replacement battery into the housing so the wires are not kinked or crushed, or do not interfere with the AC power cord.

10. Replace the battery door using the screw that was removed in Step 2.

    Note: The infuser must be powered on with AC disconnected for the device to recognize that a new battery has been installed.

To verify successful replacement of the battery, press **[ON]** with the infuser disconnected from AC power. Verify the front panel battery symbol is lit.

Replacement of the battery door, door pad, and battery strap are routine maintenance and no verification procedure is normally required. However, if the infuser may have been damaged during this procedure, perform the PVT in ***Section 5.3***.

7.3.7
PATIENT PENDANT ASSEMBLY REPLACEMENT

⚠ **CAUTION: Do not bend the patient pendant cord near the patient pendant or connector jack at an angle of 90° or greater.**

No tools are required for this procedure.

The replacement part for this procedure is:

Assembly, Patient Pendant

To replace the patient pendant assembly, see ***Figure 7-6***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Disconnect the patient pendant assembly from the patient pendant jack on the rear of the infuser.
3. Connect the replacement patient pendant assembly to the patient pendant jack.

> **Note:** Verify the LifeCare PCA replacement patient pendant cord is color-coded blue and the switch button is black.

Replacement of the patient pendant assembly is routine maintenance and no verification procedure is normally required. However, if the infuser may have been damaged during this procedure, perform the PVT in ***Section 5.3***.

7.3.8
FRONT ENCLOSURE ASSEMBLY COMPONENT REPLACEMENT

Front enclosure assembly component replacement includes removal or replacement of the following:

- Security door
- Door hinge
- Keypad
- Door latch hook
- Cradle assembly
- Mechanism lever arm
- Door latch assembly
- Door lock assembly
- Handle gasket
- Enclosure gasket
- Electronics assembly and components
- Antenna PWA
- CE PWA
- LCD window
- Mechanism assembly
- Barcode reader, gasket, and window
- Splash shield

To replace the front enclosure assembly components, see ***Figure 7-7*** and ***Figure 7-8***, and proceed as detailed in the following sections.

7.3.8.1

SECURITY DOOR AND DOOR HINGE REPLACEMENT

The recommended tool for this procedure is a No. 1 Phillips screwdriver.

Replacement parts for this procedure are:

Door, Security
Hinge, Security Door
Screw, 4-40 x 3/8, Pan Head, Phillips

To replace the security door and door hinge, see ***Figure 7-7***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Unlock the security door, and open the door approximately 270 degrees to reveal the four screws that attach the hinge.
3. Using the Phillips screwdriver, remove the four 4-40 screws and remove the hinge and the door.
4. Attach the replacement door and/or hinge using the screws that were removed in Step 3.
5. Close and lock the security door. Verify that the door aligns with the door latch assembly and that the door is locked.

Replacement of the security door and door hinge is routine maintenance and no verification procedure is normally required. However, if the infuser may have been damaged during the procedure, perform the PVT in ***Section 5.3***.

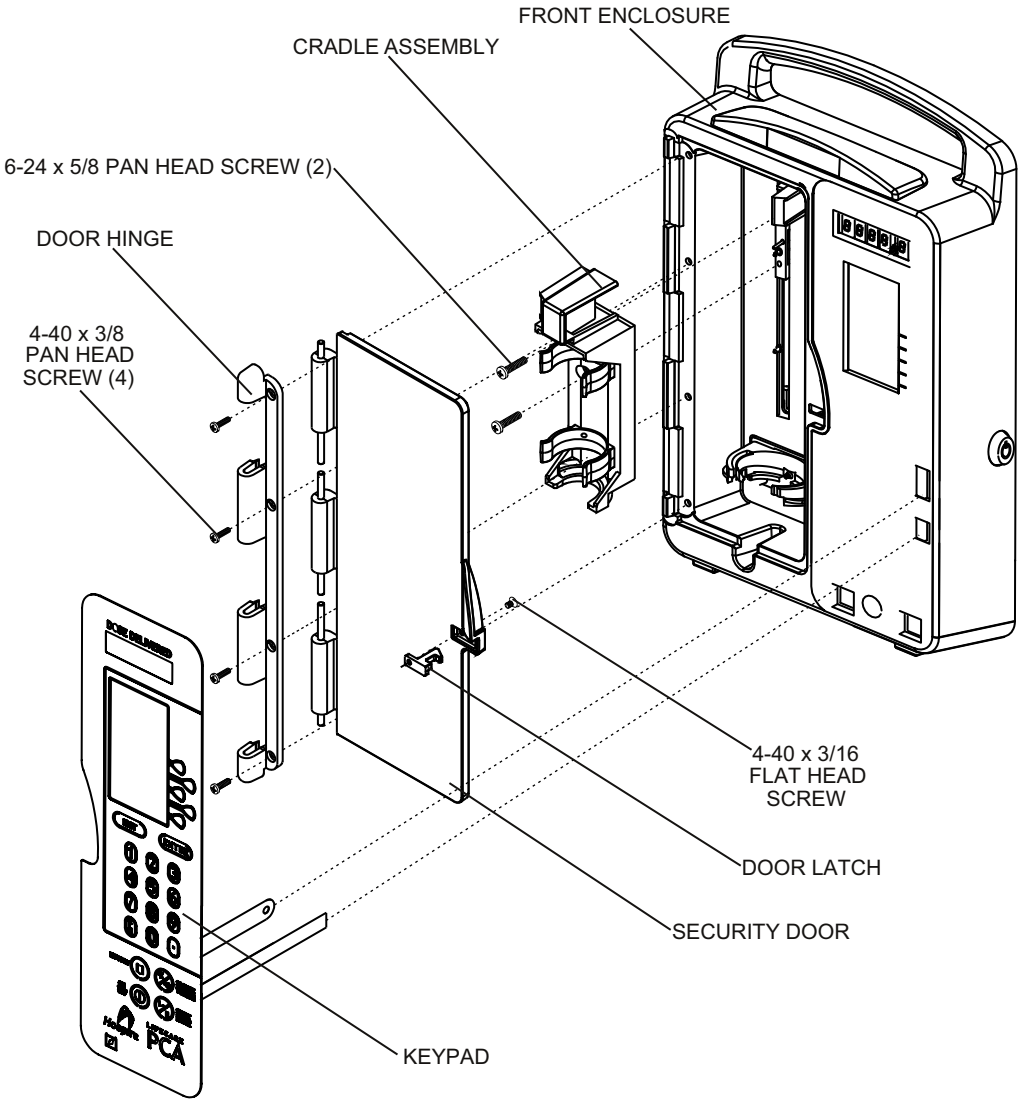

Figure 7-7. Front Enclosure Assembly External Components

7.3.8.2

KEYPAD REPLACEMENT

Recommended tools and materials for this procedure are a 1/4 inch nutdriver, an X-acto knife, isopropyl alcohol, and a lint-free cloth.

Replacement parts for this procedure are:

Keypad
Bracket, Grounding, Keypad
Kep Nut, 6-32, w/Conical Washer
Washer, Flat, #6

To replace the keypad, see ***Figure 7-7*** and ***Figure 7-8***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Disconnect the ribbon cables from J10 and J11 on the MCU PWA by pulling up on the locking tabs.
4. Using the nutdriver, remove the nut and washer that attaches the ground strap from the keypad to the keypad grounding bracket.
5. Using the X-acto knife and needle nose pliers, remove the keypad.
6. Using isopropyl alcohol, remove any adhesive remaining on the front enclosure assembly.
7. Remove the backing from the replacement keypad to expose the adhesive, and guide the ribbon cables and ground strap through the front enclosure assembly.
8. Press the keypad into place on the front enclosure assembly and connect the ribbon cables to J10 and J11 on the MCU PWA.

   Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

9. Reinstall the ground strap and grounding bracket using the nut and washer that were removed in Step 4.
10. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the keypad, perform the PVT in ***Section 5.3***.

7.3.8.3
DOOR LATCH HOOK REPLACEMENT

The recommended tool for this procedure is a No. 1 Phillips screwdriver.

Replacement parts for this procedure are:

Hook, Door Latch
Screw, 4-40 x 3/16, Flat Head, Phillips

To replace the door latch hook, see ***Figure 7-7***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Unlock and open the security door.
3. From inside the door, using the Phillips screwdriver, remove the 4-40 flat head screw that attaches the latch hook to the door.
4. Install the replacement latch hook from inside the door using the screw that was removed in Step 3.
5. Close and lock the security door.

Replacement of the door latch hook is routine maintenance and no verification procedure is normally required. However, if the infuser may have been damaged during this procedure, perform the PVT in ***Section 5.3***.

7.3.8.4
CRADLE ASSEMBLY REPLACEMENT

The recommended tool for this procedure is a No. 2 Phillips screwdriver.

Replacement parts for this procedure are:

Assembly, Cradle
Screw, 6-24 x 5/8, Pan Head, Phillips

To replace the cradle assembly, see ***Figure 7-7***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Open the security door.
4. Place the infuser face up on a soft surface.
5. Using the Phillips screwdriver, remove the two 6-24 screws that secure the cradle assembly and remove the cradle assembly.
6. Install the replacement cradle assembly using the screws that were removed in Step 5.
7. Close and lock the security door.

To verify successful replacement of the cradle assembly, perform the PVT in ***Section 5.3***.

7.3.8.5

MECHANISM LEVER ARM REPLACEMENT

The recommended tool for this procedure is a medium size flat blade screwdriver.

The replacement part for this procedure is:

Arm, Lever, Mechanism

To replace the mechanism lever arm, see ***Figure 7-8***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Remove the cradle assembly as described in ***Section 7.3.8.4***.
4. Using the flat blade screwdriver, lift the mechanism lever arm off the pivot post and pull the lever arm through the front of the infuser.
5. Install the replacement mechanism lever arm in the exact reverse order of removal.
6. Reinstall the cradle assembly.
7. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the mechanism lever arm, perform the PVT in ***Section 5.3***.

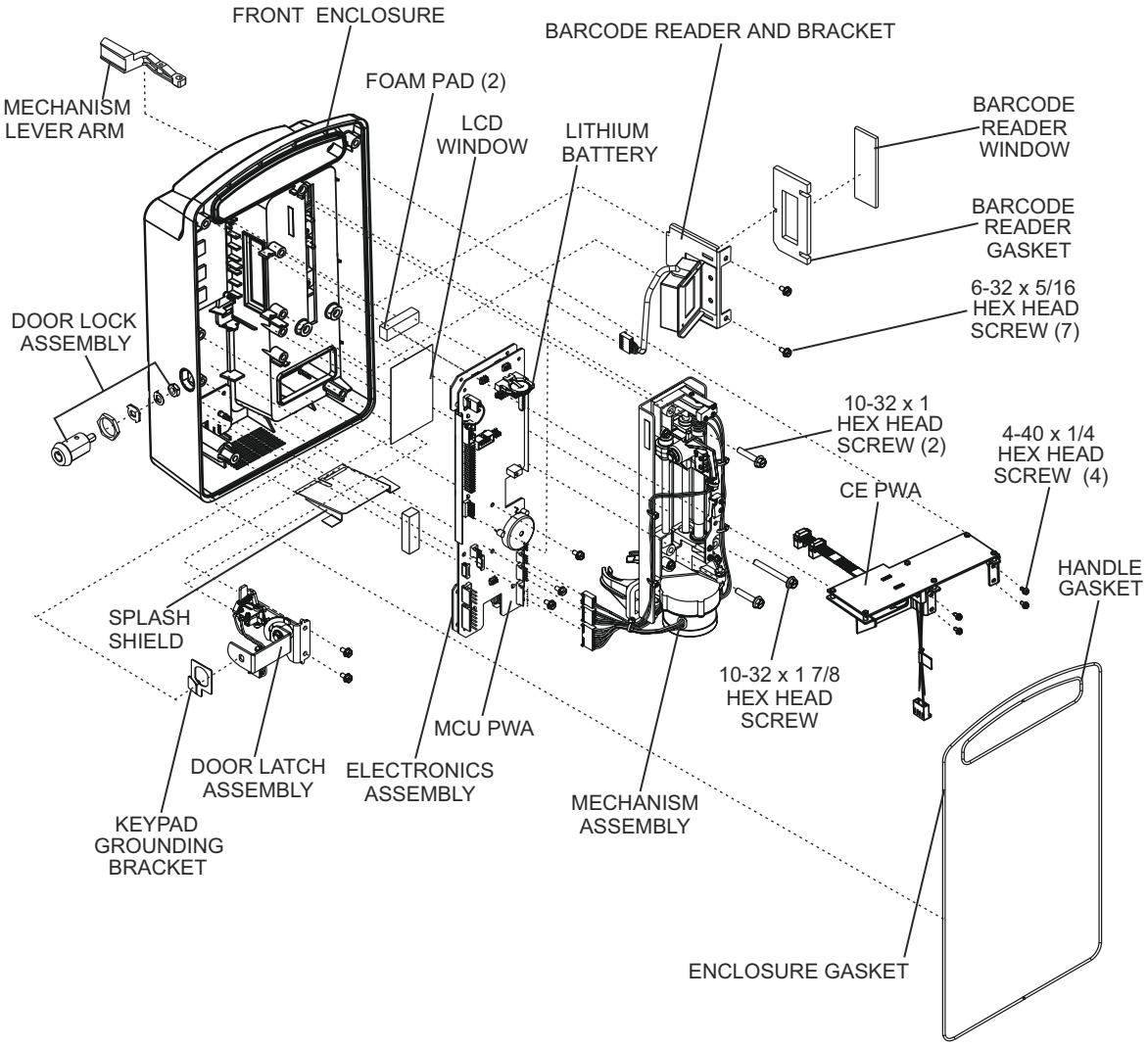

Figure 7-8. Front Enclosure Assembly Internal Components

7.3.8.6

DOOR LATCH ASSEMBLY REPLACEMENT

Recommended tools for this procedure are a 7/8 inch open end wrench, medium size flat blade screwdriver, and 1/4 inch nutdriver.

Replacement parts for this procedure are:

Assembly, Door Latch

Screw, 6-32 x 5/16, Hex Head, with Washer

To replace the door latch assembly, see ***Figure 7-8***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Disconnect the door lock cable from J12 on the MCU PWA.

4. Using the open end wrench, loosen the retainer nut that secures the lock cylinder to the front enclosure assembly ***(see Section 7.3.8.7)***. Move the lock cylinder away from the door latch assembly.
5. Remove the barcode reader as described in ***Section 7.3.8.15***.
6. Using the nutdriver or flat blade screwdriver, remove the two 6-32 hex head screws securing the door latch assembly to the front enclosure.
7. Install the replacement door latch assembly using the screws that were removed in Step 6. Confirm the door latch cam is positioned to assure proper operation of the latch.
8. Reconnect the door lock cable to the MCU PWA.
9. Reassemble the infuser in the exact reverse order of disassembly.

   Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

To verify successful replacement of the door latch assembly, perform the PVT in ***Section 5.3***.

7.3.8.7
DOOR LOCK ASSEMBLY REPLACEMENT

Recommended tools for this procedure are a 7/16 inch open end wrench, a 7/8 inch open end wrench, and needle nose pliers.

The replacement part for this procedure is:

Assembly, Door Lock

The door lock assembly kit includes a cylinder lock, a keying washer, a three-finger washer, and a 7/16 hex nut.

Pre-assembly of the replacement lock is required ***(see Figure 7-8*** and ***Figure 7-9)***, as follows:

1. Place the keying washer over the threaded shaft of the cylinder lock with the shiny (rounded) side down. Verify that the keying washer is lined up with the raised portion of the cylinder lock.
2. Place the three-finger washer over the threaded shaft. Confirm the ridged side of the fingers faces up.
3. Using the 7/16 open end wrench, tighten the nut over the washers.
4. Using the needle nose pliers, bend the washer fingers up to hold the nut in place.
5. Hold the lock, insert the key into the lock, and verify the key turns 90 degrees to the left.

Once the replacement lock cylinder is assembled, proceed as follows:

1. Disconnect the infuser from AC power.
2. Close and lock the security door.
3. Separate the front and rear enclosures as described in ***Section 7.2.2***.
4. Using the 7/8 inch open end wrench, remove the door lock retainer nut while sliding the door lock cylinder through the keypad grounding bracket and front enclosure. Note the position of the door latch cam.

5. Install the replacement door lock cylinder into the double-D hole in the front enclosure. Confirm the keyway slot is in the upward (12 o'clock) position.
6. Assemble the keypad grounding bracket and retaining nut on the door lock cylinder and insert the threaded shaft into the double-D hole in the door latch cam.
7. Using the 7/8 inch open end wrench, secure the lock to the front enclosure.
8. Confirm the door latch cam is in the up position.
9. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the door lock assembly, perform the PVT in ***Section 5.3***.

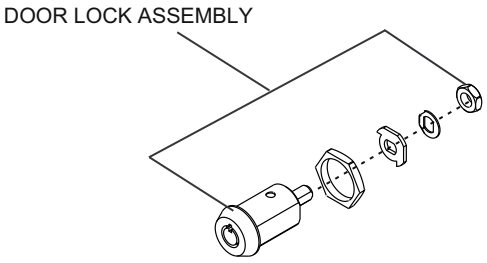

Figure 7-9. Door Lock Assembly

7.3.8.8
HANDLE GASKET AND ENCLOSURE GASKET REPLACEMENT

The recommended tool for this procedure is an X-acto knife.

Replacement parts for this procedure are:

Gasket, Handle
Gasket, Enclosure

To replace the handle and enclosure gaskets, see ***Figure 7-8***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Using the X-acto knife, carefully remove the defective gasket.
4. Install the replacement handle and/or enclosure gasket in the front enclosure.

   Note: Confirm the enclosure gasket is installed so that the seam is at the bottom of the enclosure and the handle gasket is installed so that the seam is at the top of the handle opening.

5. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the handle and enclosure gaskets, perform the PVT in ***Section 5.3***.

7.3.8.9

REMOVING THE CE PWA

CAUTION: The CE PWA is device specific and cannot be replaced with another CE PWA. Infusion system communications will not function properly with a CE PWA from another infuser. If the CE PWA is damaged, contact Hospira.

Note: This procedure is intended to facilitate other repairs only.

The recommended tool for this procedure is a 3/16 nutdriver.

The replacement part for this procedure is:

Screw, 4/40 x 1/4, Hex Head, Slotted, with Washer

To remove the CE PWA, see ***Figure 7-8***, ***Figure 7-10***, and ***Figure 7-11***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Disconnect the antenna cable from the CE PWA.
4. Using the nutdriver, remove the four hex head screws that secure the retaining bracket to the front enclosure. Remove the screws in the sequence shown in ***Figure 7-10***.
5. Grasp the PWA, moving it slightly away from the mechanism. Lift the PWA with a rolling motion and remove it from the infuser.
6. Disconnect the ribbon cables from P4 and P19.
7. Reinstall the CE PWA and secure the retaining bracket to the front enclosure using the screws that were removed in Step 4. Install the four hex head screws in the sequence shown in ***Figure 7-11***.
8. Reassemble the infuser in the exact reverse order of disassembly.

   Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

To verify successful installation of the CE PWA, perform the PVT in ***Section 5.3*** and the connectivity check in ***Section 5.4***.

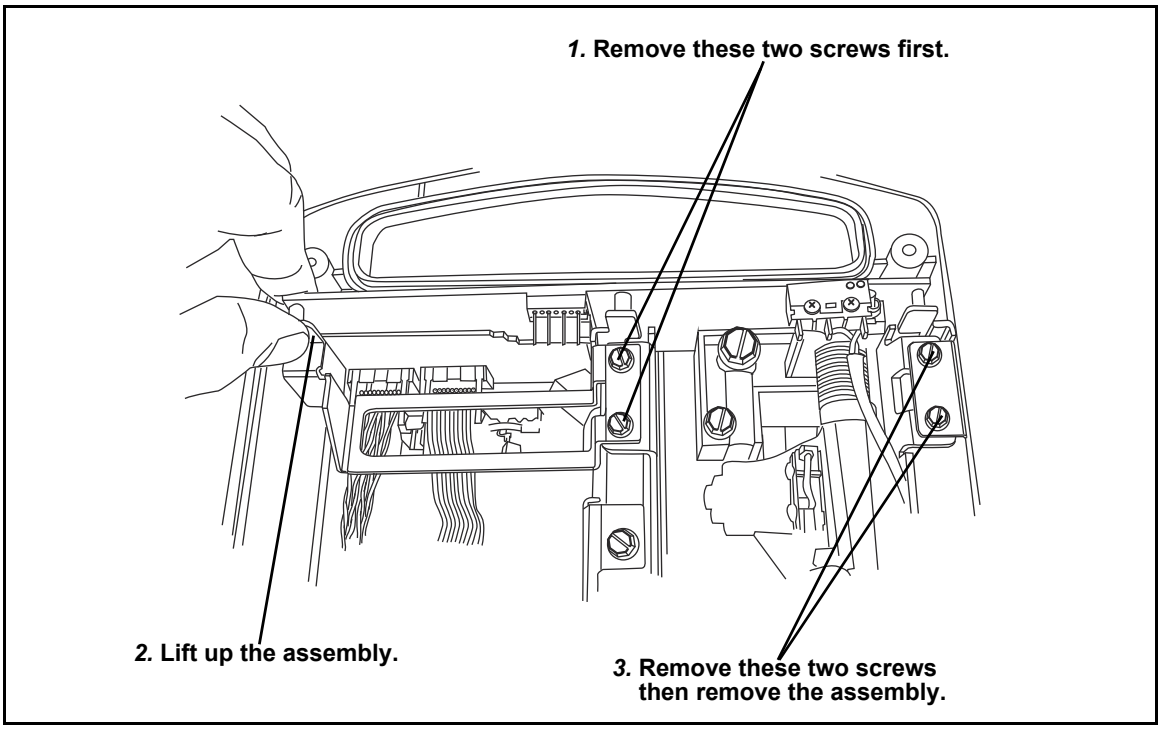

Figure 7-10. Removing the CE PWA

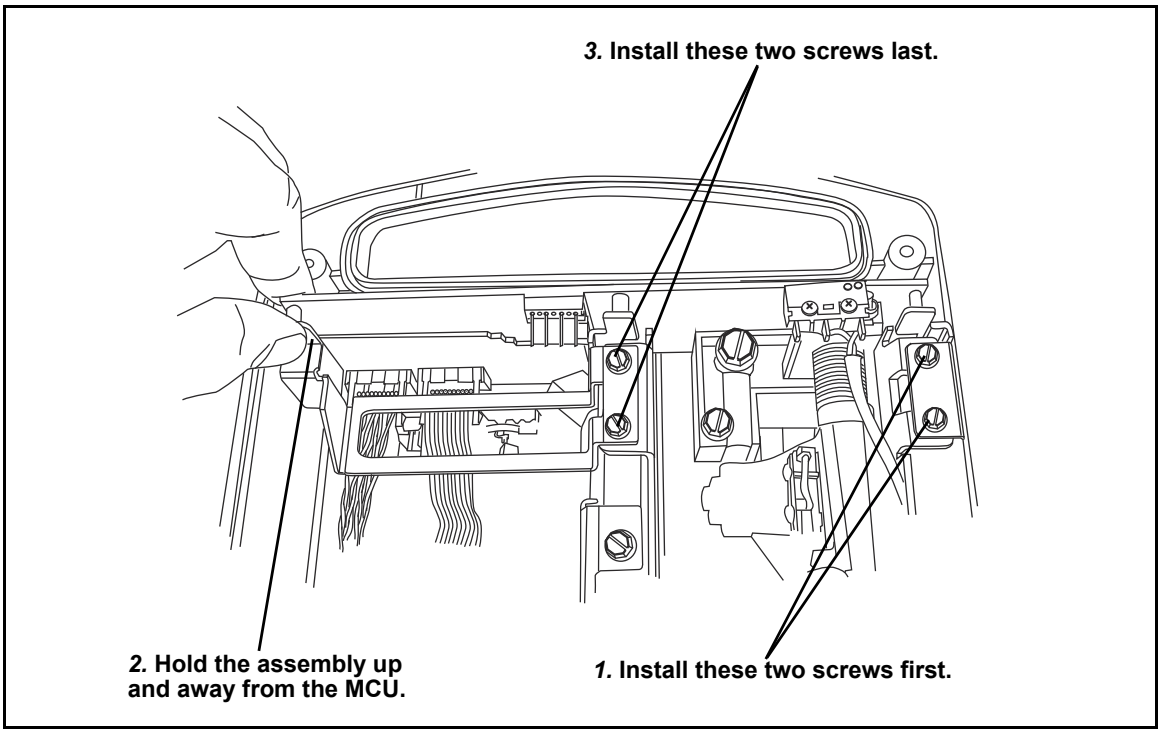

Figure 7-11. Installing the CE PWA

7.3.8.10

REMOVING THE ELECTRONICS ASSEMBLY

Note: The electronics assembly contains the MCU PWA, which is device specific and cannot be replaced by a new electronics assembly. If the electronics assembly is damaged, **contact Hospira**.

Note: This procedure is intended to facilitate other repairs only.

Recommended tools and materials for this procedure are a 1/4 inch nutdriver and mild solvent.

Replacement parts for this procedure are:

Pad, Foam

Screw, 6-32 x 5/16, Hex Head, with Washer

To remove the electronics assembly, see ***Figure 7-8*** and ***Figure 7-13***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Remove the barcode reader as described in ***Section 7.3.8.15***.
4. Remove the door latch assembly as described in ***Section 7.3.8.6***.
5. Remove the CE PWA as described in ***Section 7.3.8.9***.
6. Grasp the ribbon connector locking tabs from J10 and J11. Pull up to disengage, and disconnect the ribbon cables from the MCU PWA.
7. Disconnect P13, P16, and P18 from the MCU PWA.
8. Using the nutdriver, remove the three 6-32 hex screws that secure the electronics assembly to the front enclosure assembly.
9. Remove the electronics assembly from the front enclosure assembly by pulling the bottom of the MCU PWA up and out.
10. Inspect the two foam pads in the front enclosure assembly. If they appear damaged, replace them, removing any residue with mild solvent.
11. Reinstall the electronics assembly in the exact reverse order of removal.

    Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

12. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful installation of the electronics assembly, perform the PVT in ***Section 5.3***.

7.3.8.11

ANTENNA PWA REPLACEMENT

The recommended tools for this procedure are needle nose pliers and a flat blade screwdriver.

The replacement part for this procedure is:

PWA, Antenna

To replace the antenna PWA, see ***Figure 7-12***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Remove the electronics assembly as described in ***Section 7.3.8.10***.
4. Using needle nose pliers, grasp the retaining clips attaching the antenna PWA to the front enclosure. Squeeze the retaining clips while pushing them out.

   ⚠ **CAUTION: Do not scratch the EMI coating on the enclosure.**

5. To release the antenna cover retaining clips located over the mechanism, push down gently on the top of the retaining clips with a flat blade screwdriver while pulling the antenna housing away from the infuser.
6. Install the replacement antenna PWA in the exact reverse order of removal.

   Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

7. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the antenna PWA, perform the PVT in ***Section 5.3*** and the connectivity check in ***Section 5.4***.

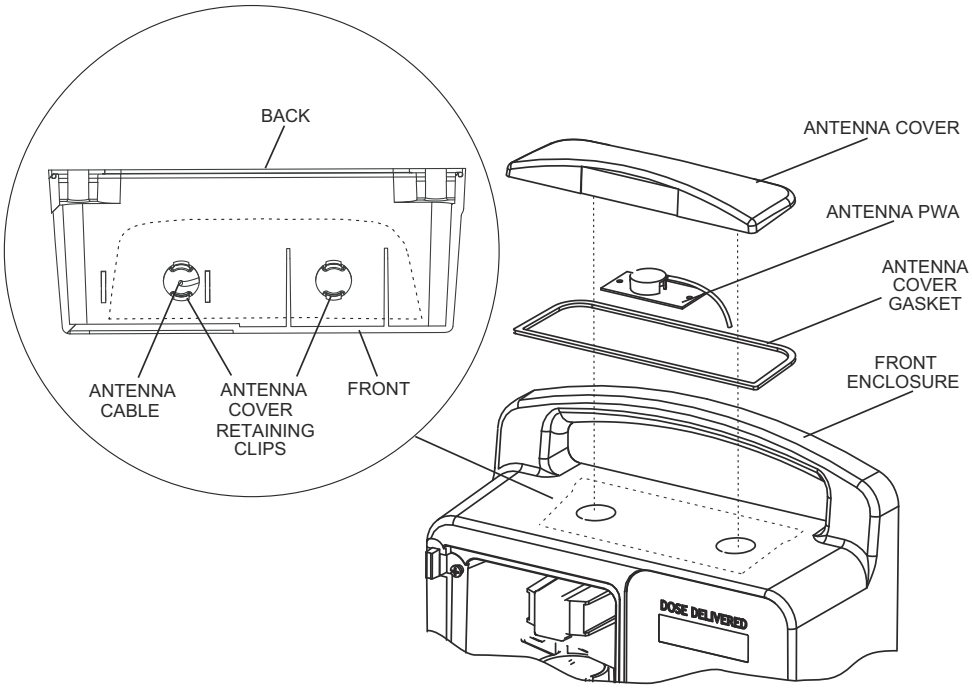

Figure 7-12. Antenna PWA Replacement

7.3.8.12
ELECTRONICS ASSEMBLY COMPONENT REPLACEMENT

Electronics assembly component replacement includes the replacement of the LCD shield, LCD assembly, numeric display PWA, icon display PWA, and lithium backup battery.

To replace the electronics assembly components, see ***Figure 7-8*** and ***Figure 7-13***, and proceed as detailed in the following sections.

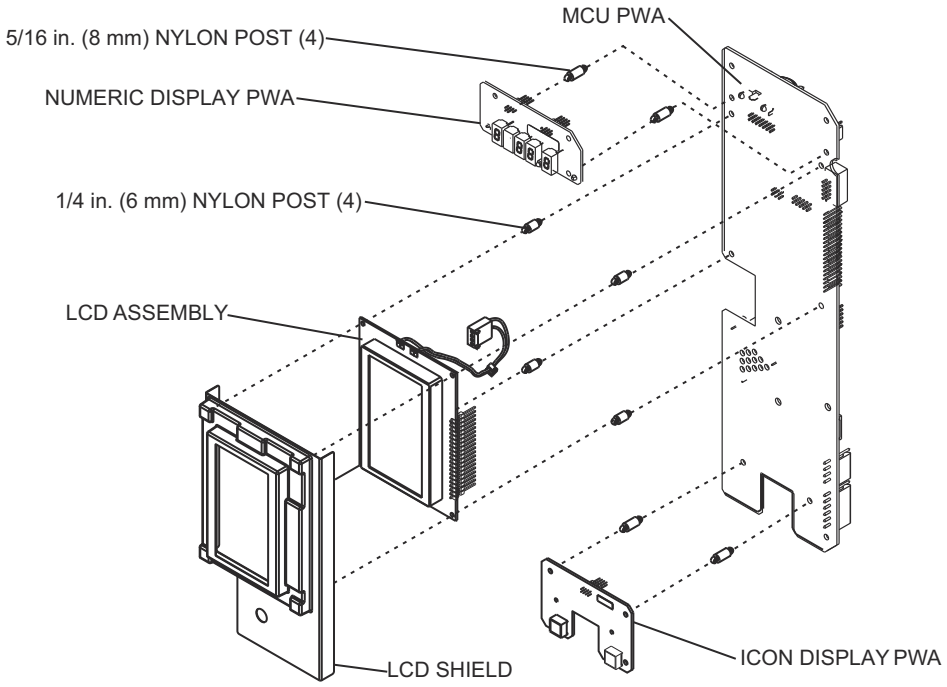

Figure 7-13. Electronics Assembly Components

7.3.8.12.1
LCD Shield Replacement

Recommended tools and materials for this procedure are an X-acto knife, isopropyl alcohol, and a lint-free cloth.

The replacement part for this procedure is:

Shield, LCD

To replace the LCD shield, see ***Figure 7-8*** and ***Figure 7-13***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Remove the electronics assembly as described in ***Section 7.3.8.10***.
4. Using the X-acto knife, lift the LCD shield from the LCD assembly.

5. Using the lint-free cloth moistened with isopropyl alcohol, clean any remaining adhesive from the LCD assembly.
6. Remove the protective backing from the replacement LCD shield to expose the adhesive. Center the shield over the LCD and press the shield into place on the LCD.
7. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the LCD shield, perform the PVT in ***Section 5.3***.

7.3.8.12.2

LCD Assembly Replacement

Recommended tools for this procedure are diagonal cutters and needle nose pliers.

Replacement parts for this procedure are:

Assembly, LCD
Post, Nylon

To replace the LCD assembly, see ***Figure 7-8*** and ***Figure 7-13***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Remove the electronics assembly as described in ***Section 7.3.8.10***.
4. Remove the LCD shield as described in ***Section 7.3.8.12.1***.
5. Disconnect P3 from J3 on the MCU PWA.
6. Using the diagonal cutters, snip off the ends of the four nylon hardware posts attaching the LCD assembly to the MCU PWA. Remove the defective LCD assembly.
7. Remove the remaining portion of the nylon hardware posts from the MCU PWA with needle nose pliers.

   ⚠ **CAUTION: Exercise care when replacing or reinstalling the nylon posts. Applying excessive pressure on the posts may bend or damage the PWAs.**

8. Place the MCU PWA on a stable surface. Align the nylon hardware posts on the replacement LCD assembly with the four holes on the MCU PWA, and press carefully to attach the LCD assembly.

   Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

9. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the LCD assembly, perform the PVT in ***Section 5.3***.

7.3.8.12.3

Numeric Display PWA Replacement

Recommended tools for this procedure are diagonal cutters and needle nose pliers.

Replacement parts for this procedure are:

PWA, Numeric Display

Post, Nylon

To replace the numeric display PWA, see ***Figure 7-8*** and ***Figure 7-13***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Remove the electronics assembly as described in ***Section 7.3.8.10***.
4. Using the diagonal cutters, snip off the ends of the four nylon hardware posts attaching the numeric display PWA to the MCU PWA. Remove the defective numeric display PWA.
5. Remove the remaining portion of the nylon hardware posts from the MCU PWA using needle nose pliers.

   CAUTION: Exercise care when replacing or reinstalling the nylon posts. Applying excessive pressure on the posts may bend or damage the PWAs.

6. Place the MCU PWA on a stable surface. Align the nylon hardware posts on the replacement numeric display PWA with the two holes on the MCU PWA, and press carefully to attach the numeric display PWA.
7. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the numeric display PWA, perform the PVT in ***Section 5.3***.

7.3.8.12.4

Icon Display PWA Replacement

Recommended tools for this procedure are diagonal cutters and needle nose pliers.

Replacement parts for this procedure are:

PWA, Icon Display

Post, Nylon

To replace the icon display PWA, see ***Figure 7-8*** and ***Figure 7-13***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Remove the electronics assembly as described in ***Section 7.3.8.10***.
4. Using the diagonal cutters, snip off the ends of the four nylon hardware posts attaching the icon display PWA to the MCU PWA. Remove the defective icon display PWA.

5. Remove the remaining portion of the nylon hardware posts from the MCU PWA with needle nose pliers.

   ⚠ **CAUTION: Exercise care when replacing or reinstalling the nylon posts. Applying excessive pressure on the posts may bend or damage the PWAs.**

6. Place the MCU PWA on a stable surface. Align the nylon hardware posts on the replacement icon display PWA with the two holes on the MCU PWA, and press carefully to attach the icon display PWA.

7. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the icon display PWA, perform the PVT in ***Section 5.3***.

7.3.8.12.5

Lithium Battery Replacement

⚠ **CAUTION: Replacement of the lithium battery must be completed within approximately 5 to 7 minutes in order to avoid data corruption and loss of the serial number.**

No tools are required for this procedure.

The replacement part for this procedure is:

Battery, Lithium

To replace the lithium battery, see ***Figure 7-8***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Place the front enclosure face down on a soft, flat surface.
4. Remove the lithium battery by grasping it with thumb and forefinger, rotating slightly clockwise, and pulling up and to the left.
5. Observing polarity (**+** side down), align the replacement lithium battery with the battery holder and push straight down until the battery snaps into place.
6. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the lithium battery, perform the PVT in ***Section 5.3***.

7.3.8.13

LCD WINDOW REPLACEMENT

The recommended tool for this procedure is an X-acto knife.

The replacement part for this procedure is:

Window, LCD

To replace the LCD window, see ***Figure 7-8***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Remove the electronics assembly as described in ***Section 7.3.8.10***.
4. Using the X-acto knife, remove the LCD window from the front enclosure.

5. Remove the protective backing from the replacement LCD window to expose the adhesive.
6. Center the replacement LCD window over the opening in the front enclosure and press the window into place on the front enclosure.
7. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the LCD window, perform the PVT in ***Section 5.3***.

7.3.8.14
MECHANISM ASSEMBLY REPLACEMENT

Recommended tools for this procedure are a No. 2 Phillips screwdriver and 5/16 inch nutdriver.

Replacement parts for this procedure are:

Assembly, Mechanism
Screw, 10-32 x 1, Hex Head
Screw, 10-32 x 1 3/4, Hex Head

To replace the mechanism assembly, see ***Figure 7-8***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Remove the cradle assembly as described in ***Section 7.3.8.4***.
4. Remove the mechanism lever arm as described in ***Section 7.3.8.5***.
5. Disconnect the three mechanism cables from the MCU PWA.
6. Place the infuser face down on a soft surface. Using the nutdriver, remove the three 10-32 screws that secure the mechanism assembly to the front enclosure.
7. Install the replacement mechanism assembly using the screws that were removed in Step 6.
8. Reinstall the mechanism lever arm and cradle assembly.
9. Reassemble the infuser in the exact reverse order of disassembly.

> **Note:** Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

To verify successful replacement of the mechanism assembly, perform the PVT in ***Section 5.3***.

7.3.8.15

BARCODE READER, GASKET, AND WINDOW REPLACEMENT

Recommended tools and materials for this procedure are a 1/4 inch nutdriver, an X-acto knife, isopropyl alcohol, and a lint-free cloth.

Replacement parts for this procedure are:

Reader, Barcode
Gasket, Barcode Reader
Window, Barcode Reader
Bracket, Barcode Reader

To replace the barcode reader, gasket, and window, see ***Figure 7-8***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Disconnect the barcode reader cable from J8 on the MCU PWA.
4. Using the nutdriver, remove the two 6-32 screws from the barcode reader bracket.

   Note: The barcode window is not secured in place and will fall free when the barcode reader is removed.

5. Remove the barcode reader by pulling it up and off the mounting pins on the front enclosure.

   ⚠ **CAUTION: Handle the barcode window using only a lint-free cloth. Do not touch the window. Fingerprints or other contamination can degrade barcode reader performance.**

6. Using the X-acto knife, remove the barcode reader gasket from the barcode reader bracket. Clean the bracket with isopropyl alcohol and dry thoroughly.
7. Remove the protective backing from the replacement barcode reader gasket and adhere the gasket to the barcode reader bracket.
8. Install the replacement barcode reader and window using the screws that were removed in Step 4.
9. Reconnect the barcode reader cable to the MCU PWA.

   Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

10. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the barcode reader, gasket, and window, perform the PVT in ***Section 5.3***.

7.3.8.16
SPLASH SHIELD REPLACEMENT

The recommended tool for this procedure is an X-acto knife.

The replacement part for this procedure is:

Shield, Splash

To replace the splash shield, see ***Figure 7-8***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Using the X-acto knife, remove the splash shield from the front enclosure.
4. Remove the protective backing from the replacement splash shield (two places) to expose the adhesive and install the shield into the front enclosure.
5. Reassemble the infuser in the exact reverse order of disassembly.

To verify successful replacement of the splash shield, perform the PVT in ***Section 5.3***.

7.3.9
REAR ENCLOSURE ASSEMBLY COMPONENT REPLACEMENT

Rear enclosure assembly component replacement includes the replacement of the following:

- Fuses
- Pole clamp assembly
- Velcro strap and retainer plate
- Power supply PWA
- Pawl/ratchet assembly
- Rear enclosure harness assembly
- Equipotential post
- Pole clamp nut plate
- Left/right ground straps
- Interface panel ground strap
- Battery pad
- I/O PWA
- Patient pendant jack assembly

To replace the rear enclosure assembly components, see ***Figure 7-14*** *and* ***Figure 7-15***, and proceed as detailed in the following sections.

> **Note:** Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

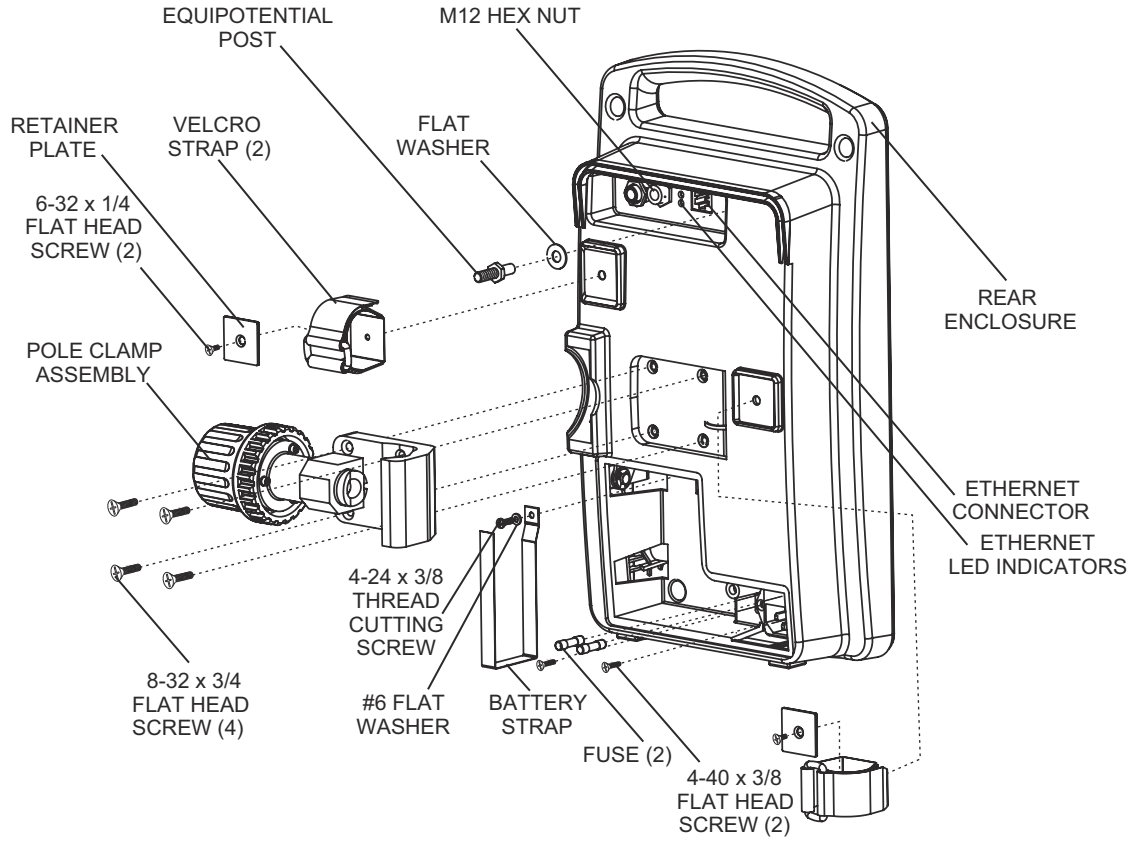

Figure 7-14. Rear Enclosure External Components

7.3.9.1

FUSE REPLACEMENT

Recommended tools for this procedure are a No. 2 Phillips screwdriver and a small flat blade screwdriver.

The replacement part for this procedure is:

Fuse, .5 A, 250 V, Slo-Blo

To replace the fuses, see ***Figure 7-14***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Using the Phillips screwdriver, remove the screw that attaches the battery door to the rear of the infuser.
3. To access the fuses, remove the AC power cord from its receptacle by grasping the plug. Do not pull on the cord.
4. Locate the plastic fuseholder directly above the AC power receptacle. Insert the flat blade screwdriver between the locking tab at the center bottom of the fuseholder and the infuser housing. Press the tab toward the center of the fuseholder to release it.

5. Remove the fuses and replace them with approved fuses only ***(see Section 8)***. Do not use any other fuse types.
6. Insert the fuseholder into the receptacle, then press the fuseholder down until it clicks into position.
7. Replace the AC power cord.
8. Reinstall the battery door with the screw that was removed in Step 2.
9. Connect the infuser to AC power.

Fuse replacement is routine maintenance and no verification procedure is normally required. However, if the infuser may have been damaged during this procedure, perform the PVT in ***Section 5.3***.

7.3.9.2

POLE CLAMP ASSEMBLY REPLACEMENT

The recommended tool for this procedure is a No. 2 Phillips screwdriver.

Replacement parts for this procedure are:

Assembly, Pole Clamp
Screw, 8-32 x 3/8, Flat Head, Phillips
Washer, Lock, #8

To replace the pole clamp assembly, see ***Figure 7-14***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Place the infuser face down on a soft surface.
3. Using the Phillips screwdriver, remove the four 8-32 screws and lock washers.
4. Remove the pole clamp assembly.
5. Install the replacement pole clamp assembly using the screws and lock washers that were removed in Step 3.
6. Connect the infuser to AC power.

Replacement of the pole clamp assembly is routine maintenance and no verification procedure is normally required. However, if the infuser may have been damaged during this procedure, perform the PVT in ***Section 5.3***.

7.3.9.3

VELCRO STRAP AND RETAINER PLATE REPLACEMENT

Velcro straps and retainer plates on the rear of the infuser secure the patient pendant and the AC power cord. This procedure details the replacement of the Velcro strap and retainer plate in both locations.

Recommended tools for this procedure are a No. 2 Phillips screwdriver, an X-acto knife, and a permanent marker.

Replacement parts for this procedure are:

Strap, Velcro
Plate, Retainer, Velcro Strap
Screw, 6-32 x 1/4, Flat Head, Phillips

To replace the Velcro strap and retainer plate, see ***Figure 7-14***, and proceed as follows:

1. Using the Phillips screwdriver, remove the screw that attaches the Velcro strap and retainer plate to the rear of the infuser. Remove the retainer plate and strap. Do not discard the strap.

   Note: The replacement Velcro strap does not have a hole for the mounting screw. The hole must be cut at the time of installation.

2. Place the replacement Velcro strap, with fuzzy side down, on the work surface. Place the retainer plate on the strap in the exact location as on the old strap. Use the retainer plate as a template to locate the hole location on the strap. Mark the location with the permanent marker.

3. Using the X-acto knife, cut a hole in the replacement strap at the marked location.

4. Inspect the retainer plate, and replace, if required.

5. Install the replacement strap and retainer plate using the screw that was removed in Step 1.

6. Connect the infuser to AC power.

Replacement of the Velcro strap and retainer plate is routine maintenance and no verification procedure is normally required. However, if the infuser may have been damaged during this procedure, perform the PVT in ***Section 5.3***.

7.3.9.4
POWER SUPPLY PWA REPLACEMENT

Recommended tools for this procedure are a 3/16 inch nutdriver and a small flat blade screwdriver.

Replacement parts for this procedure are:

PWA, Power Supply
Shield, Power Supply
Screw, 4-40 x 5/16, Hex Head
Standoff, 4-40, M/F, Hex

To replace the power supply PWA, see ***Figure 7-16***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Using the nutdriver, remove the 4-40 screw that secures the power supply shield, and fold the shield away from the power supply.
4. Using the nutdriver, remove the M/F standoff.
5. Disconnect the rear enclosure harness assembly from the power supply PWA.
6. Using the nutdriver and/or screwdriver, remove the three 4-40 screws and remove the power supply from the rear enclosure.
7. Remove and inspect the power supply shield, and replace, if required.
8. Install the replacement power supply PWA and power supply shield in the exact reverse order of removal.

   Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

9. Connect the infuser to AC power.

To verify successful replacement of the power supply PWA, perform the PVT in ***Section 5.3***.

7.3.9.5
PAWL/RATCHET ASSEMBLY REPLACEMENT

The recommended tool for this procedure is a 1/4 inch nutdriver.

Replacement parts for this procedure are:

Assembly, Pawl/Ratchet
Screw, 8-32 x 3/8, Hex Head

To replace the pawl/ratchet assembly, see ***Figure 7-16***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Using the nutdriver, remove the two 8-32 screws that secure the pawl/ratchet assembly to the rear enclosure.

4. Lift the pawl/ratchet assembly from the rear enclosure.
5. Install the replacement pawl/ratchet assembly in the exact reverse order of removal.
6. Reassemble the infuser in the exact reverse order of disassembly.
7. Connect the infuser to AC power.

To verify successful replacement of the pawl/ratchet assembly, perform the PVT in ***Section 5.3***.

7.3.9.6

REAR ENCLOSURE HARNESS ASSEMBLY, EQUIPOTENTIAL POST, AND GROUND STRAP REPLACEMENT

Recommended tools for this procedure are diagonal cutters, a set of nutdrivers, a 10 mm open end wrench, and a medium flat head screwdriver.

Replacement parts for this procedure are:

Assembly, Harness, Rear Enclosure	**Nut, Hex, 4-40**
Strap, Ground, Left/Right	**Nut, Hex, 6-32**
Post, Equipotential	**Washer, Lock, #4**
Plate, Nut, Pole Clamp	**Washer, Flat, #4**
Ring, Terminal	**Wrap, Spiral**
Nut, Hex, M6	**Tie, Cable**

To replace the rear enclosure harness assembly, equipotential post, and left and right ground straps, see ***Figure 7-14***, ***Figure 7-15***, or ***Figure 7-16***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosures as described in ***Section 7.2.2***.
3. Using the diagonal cutters, remove the cable ties that secure the patient pendant harness to the rear enclosure harness assembly.
4. Remove the power supply shield as described in ***Section 7.3.9.4***.
5. Disconnect the rear enclosure harness assembly from the power supply PWA.
6. Using the open end wrench, remove the hex nut from the equipotential post.
7. Remove the nut, lock washer, flat washer, terminal (yellow/green wire), and flat washer from the equipotential post. Remove and inspect the equipotential post, and replace, if required.
8. Using a 5/16 inch nutdriver, remove the three 6-32 nuts that secure the rear enclosure harness assembly to the pole clamp nut plate.
9. Using a 3/16 inch nutdriver, remove the 4-40 nuts and washers that secure the AC connector to the rear enclosure.
10. Remove the rear enclosure harness assembly by carefully pulling it through the rear enclosure.

11. Inspect the left and right ground straps, and replace, if damaged.
12. Install the replacement rear enclosure harness assembly in the exact reverse order of removal ***(see Figure 7-15)***.

    Note: Confirm the spiral wrap and cable ties are securely installed on the rear enclosure harness assembly.

    Note: Verify all connectors are fully seated before the front and rear enclosures are closed and fastened.

13. Reassemble the infuser in the exact reverse order of disassembly.
14. Connect the infuser to AC power.

To verify successful replacement of the rear enclosure harness assembly, equipotential post, and ground straps, perform the PVT in ***Section 5.3***.

7.3.9.7
I/O PWA REPLACEMENT

The recommended tool for this procedure is needle nose pliers.

Replacement parts for this procedure are:

PWA, I/O
Gasket, Conductive, I/O PWA

To replace the I/O PWA, see ***Figure 7-16***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosure assemblies as described in ***Section 7.2.2***.
3. Remove the equipotential post as described in ***Section 7.3.9.6***.
4. Using needle nose pliers, remove the nut that connects the nurse call jack to the rear enclosure.
5. Lift the I/O PWA out of the rear enclosure.
6. Inspect the conductive gasket, and replace, if required.
7. Install the replacement I/O PWA in the exact reverse order of removal.
8. Reassemble the infuser in the exact reverse order of disassembly.
9. Connect the infuser to AC power.

To verify successful replacement of the I/O PWA, perform the PVT in ***Section 5.3*** and the connectivity check in ***Section 5.4***.

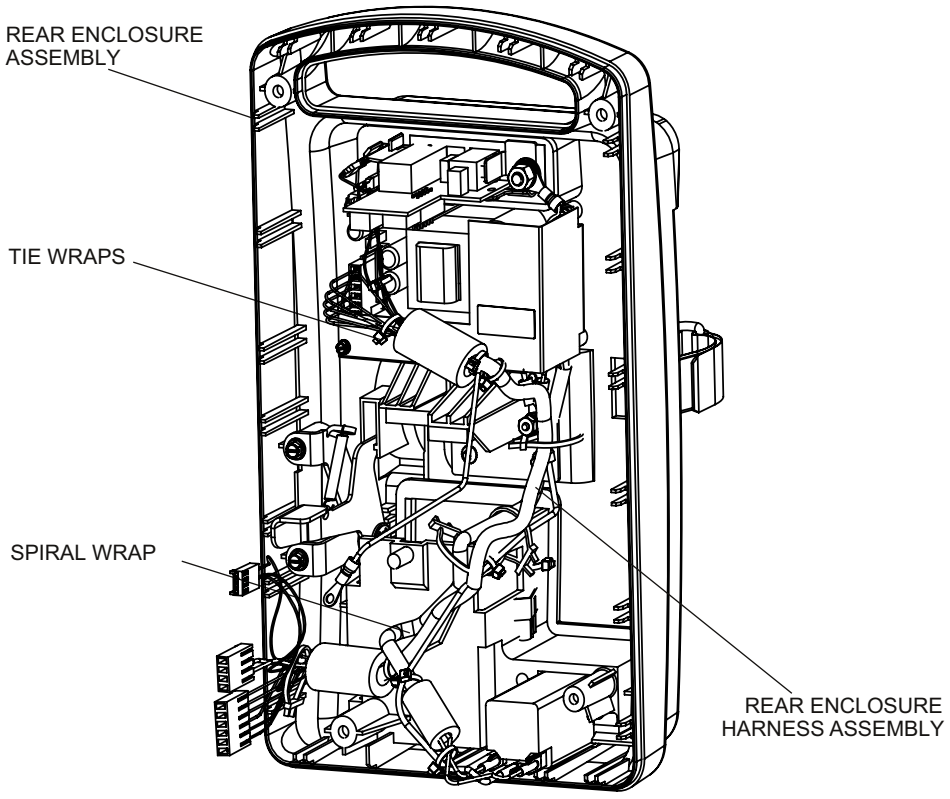

Figure 7-15. Rear Enclosure Harness Assembly

7.3.9.8

BATTERY PAD REPLACEMENT

Recommended tools and materials for this procedure are an X-acto knife, isopropyl alcohol, and a lint-free cloth.

The replacement part for this procedure is:

Pad, Battery

To replace the battery pad, see ***Figure 7-16***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosure assemblies as described in ***Section 7.2.2***.
3. Using the X-acto knife, carefully remove the battery pad from the rear enclosure.
4. Using a lint-free cloth moistened with isopropyl alcohol, clean any adhesive residue from the enclosure.
5. Remove the protective backing from the replacement battery pad to expose the adhesive and install the pad into the rear enclosure.
6. Reassemble the infuser in the exact reverse order of disassembly.
7. Connect the infuser to AC power.

To verify successful replacement of the battery pad, perform the PVT in ***Section 5.3***.

7.3.9.9

PATIENT PENDANT JACK ASSEMBLY REPLACEMENT

⚠ **CAUTION: Do not bend the patient pendant cord near the patient pendant or connector jack at an angle of 90° or greater.**

Recommended tools for this procedure are a 1/2 inch nutdriver, diagonal cutters, and cable ties.

Replacement parts for this procedure are:

Assembly, Patient Pendant Jack

Tie, Cable

To replace the patient pendant jack assembly, see ***Figure 7-15*** and ***Figure 7-16***, and proceed as follows:

1. Disconnect the infuser from AC power.
2. Separate the front and rear enclosure assemblies as described in ***Section 7.2.2***.
3. Using the nutdriver, remove the retainer nut and flat washer that attach the patient pendant jack to the rear enclosure.
4. Using the diagonal cutters, remove the cable ties that secure the patient pendant jack assembly to the rear enclosure harness assembly.
5. Remove the spiral wrap and the patient pendant jack assembly.
6. Install the replacement patient pendant jack assembly in the exact reverse order of removal. Secure the patient pendant jack harness to the rear enclosure harness assembly with the spiral wrap and cable ties.
7. Reassemble the infuser in the exact reverse order of disassembly.
8. Connect the infuser to AC power.

To verify successful replacement of the patient pendant jack assembly, perform the PVT in ***Section 5.3***.

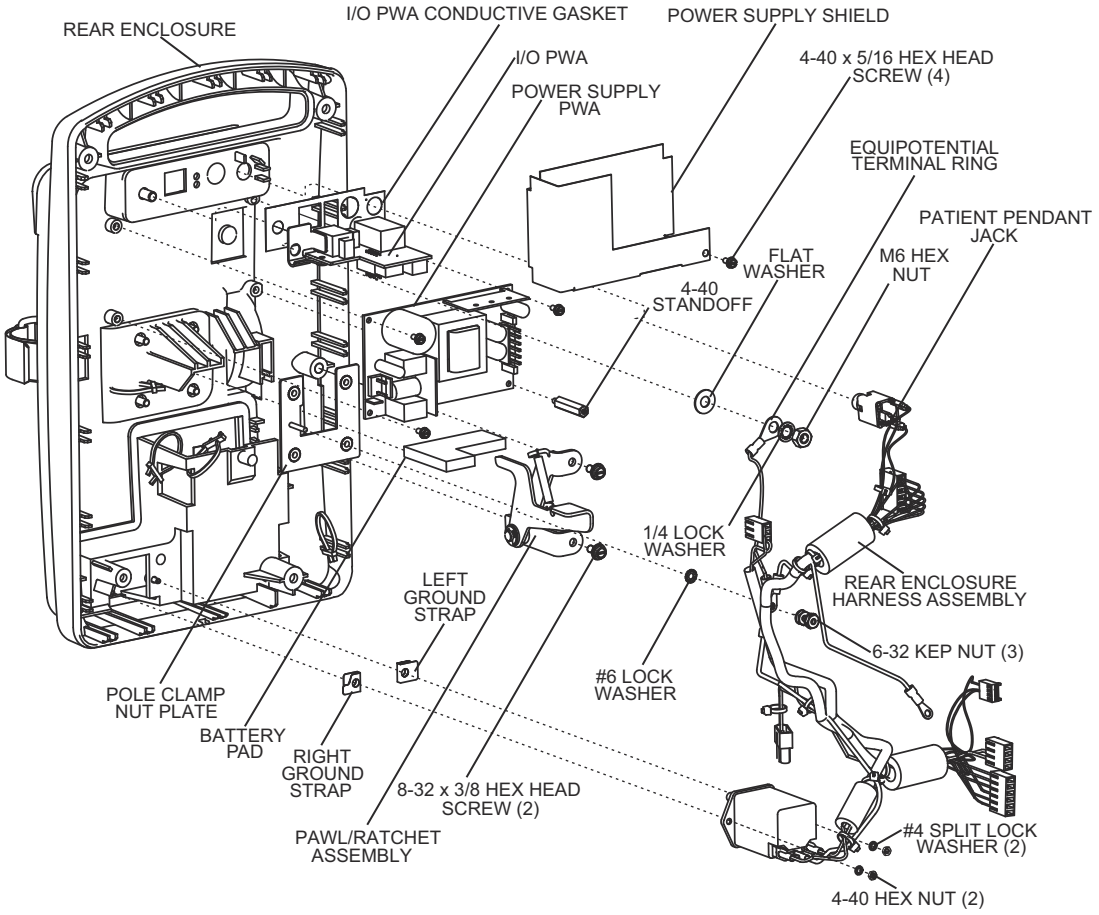

Figure 7-16. Rear Enclosure Internal Components

Section 8

SPECIFICATIONS

PHYSICAL	
Dimensions:	Approximately 8 in. W x 13 in. H x 6 in. D (excluding pole clamp and power cord)
Weight:	Approximately 10 lbs. with battery
Casing:	High-impact plastic
***Expected Service Life:**	5 years
ELECTRICAL	
Power Requirements:	120 V, 50-60 Hz, 50 VA max.
Power Cord:	Hospital-grade AC cord; 10 ft. (3 meters); with transparent plug and retainer plate
Fuses:	0.5 A, 250 V; Slo-Blo
Battery:	One sealed lead acid; rechargeable; 8 V; internal to the device
Battery Operation:	A fully charged conditioned battery shall provide at least three hours of continuous operation from the start of delivery at 5 mL/hr to dead battery Operation time is measured from initial pumping to the **LOW BATTERY** alarm
Recharge:	The battery charges whenever the infuser is connected to AC power After a **LOW BATTERY** alarm, the battery will recharge to 80% of full capacity within 16 hours
Self-Discharge:	A fully charged battery will retain a minimum 20% of the initial charge for six months when the infuser is not connected to AC power or is not operating, and is stored at 20° C
ENVIRONMENT	
Operating:	41° to 104° F (5° to 40° C) 10% to 90% relative humidity
Transporting and Storage:	-4° to 140° F (-20° to 60° C) 10% to 90% relative humidity
Atmospheric Pressure:	0 - 10,000 feet (0 - 3000 meters) or equivalent atmospheric pressure
Relative Humidity:	10 - 90% non-condensing up to 104° F (40° C); maximum of 15% non-condensing above 104° F (40° C)

When the mechanism assembly is replaced or refurbished after five years, the expected service life of the device will be ten years from the date of the installation of the new device.

OCCLUSION ALARM AND LIMITS

Backpressure Range: 10 to 20 psi

MODES

PCA Only: Approximately 1 mL in 35 seconds

Continuous Only: Variable from 0.1 x concentration to 20 x concentration (mg/hr or mcg/hr)

PCA + Continuous: Variable from 0.1 x concentration to 20 x concentration (mg/hr or mcg/hr)

Lockout Interval Range: 5 to 120 minutes in one minute increments

Section 9

DRAWINGS

Figure 9-1 through ***Figure 9-7*** show the illustrated parts breakdown (IPB) and assembly diagrams. ***Table 9-1*** lists drawings by figure number and title. ***Table 9-2*** identifies parts by index numbers which correlate to ***Figure 9-1***.

Drawings in ***Section 9*** are provided as information only, and may not exactly reflect current product configuration.

Note: PWA schematic drawings are available from Hospira upon request.

Table 9-1. Drawings

Figure Number	Title
9-1	Illustrated Parts Breakdown (2 Sheets)
9-2	Final Assembly
9-3	Front Enclosure Assembly (2 Sheets)
9-4	Rear Enclosure Assembly (2 Sheets)
9-5	Electronics Assembly
9-6	Mechanism Assembly
9-7	Antenna Assembly

Table 9-2. Illustrated Parts Breakdown		
Index Number	**Nomenclature**	**Replacement Procedure**
1	Assembly, Mechanism	***Section 7.3.8.14***
2	Assembly, Cradle	***Section 7.3.8.4***
3	Enclosure, Rear	***Section 7.3.3***
4	Enclosure, Front	***Section 7.3.3***
5	Keypad	***Section 7.3.8.2***
6	Door, Security	***Section 7.3.8.1***
7	Hinge, Security Door	***Section 7.3.8.1***
8	Assembly, Electronics	***Section 7.3.8.10***
9	Battery, Lithium	***Section 7.3.8.12.5***
10	PWA, MCU	***Section 7.3.8.12***
11	PWA, Icon Display	***Section 7.3.8.12.4***
12	Shield, LCD	***Section 7.3.8.12.1***
13	Assembly, LCD	***Section 7.3.8.12.2***
14	PWA, Numeric Display	***Section 7.3.8.12.3***
15	PWA, Power Supply	***Section 7.3.9.4***
16	Assembly, CE PWA w/Bracket	***Section 7.3.8.9***
17	Assembly, Antenna	***Section 7.3.8.11***
18	Assembly, I/O PWA w/Bracket	***Section 7.3.9.7***
19	Gasket, Conductive, I/O PWA	***Section 7.3.9.7***
20	Gasket, Enclosure	***Section 7.3.8.8***
21	Gasket, Handle	***Section 7.3.8.8***
22	Cordset, AC Power, Hospital Grade	***Section 7.3.5***
23	Assembly, Harness, Rear Enclosure	***Section 7.3.9.6***
24	Assembly, Jack, Patient Pendant	***Section 7.3.9.9***
25	Hook, Door Latch	***Section 7.3.8.3***
26	Assembly, Door Lock	***Section 7.3.8.7***
27	Post, Equipotential	***Section 7.3.9.6***
28	Assembly, Battery, w/Wire Harness	***Section 7.3.6***
29	Door, Battery	***Section 7.3.6***
30	Pad, Battery Door	***Section 7.3.6***

Table 9-2. Illustrated Parts Breakdown		
Index Number	**Nomenclature**	**Replacement Procedure**
31	Reader, Barcode	***Section 7.3.8.15***
32	Bracket, Barcode Reader	***Section 7.3.8.15***
33	Window, Barcode Reader	***Section 7.3.8.15***
34	Gasket, Barcode Reader	***Section 7.3.8.15***
35	Post, Nylon, 6 mm/Post, Nylon, 1/4	As applicable
36	Post, Nylon, 8 mm/Post, Nylon, 5/16	As applicable
37	Fuse, .5 A, 250 V, Slo-Blo	***Section 7.3.9.1***
38	Plate, Retainer, Velcro Strap	***Section 7.3.9.3***
39	Strap, Battery	***Section 7.3.6***
40	Strap, Velcro	***Section 7.3.9.3***
41	Shield, Splash	***Section 7.3.8.16***
42	Pad, Battery	***Section 7.3.9.8***
43	Window, LCD	***Section 7.3.8.13***
44	Assembly, Door Latch	***Section 7.3.8.6***
45	Assembly, Pawl/Ratchet	***Section 7.3.9.5***
46	Assembly, Pole Clamp	***Section 7.3.9.2***
47	Arm, Lever, Mechanism	***Section 7.3.8.5***
48	Strap, Ground, Right	***Section 7.3.9.6***
49	Strap, Ground, Left	***Section 7.3.9.6***
50	Bracket, Grounding, Keypad	***Section 7.3.8.2***
51	Pad, Rubber Foot	***Section 7.3.4***
52	Pad, Foam	***Section 7.3.8.10***
53	Plate, Nut, Pole Clamp	***Section 7.3.9.6***
54	Shield, Power Supply	***Section 7.3.9.4***
55	Washer, Lock, Conical, External Tooth, #8	As applicable
56	Washer, Lock, External Tooth, #6, SS	As applicable
57	Washer, Split, Lock, #6	As applicable
58	Washer, Split, Lock, Helical	As applicable
59	Washer, Lock, 1/4, .025 Thk., Internal Tooth	As applicable
60	Washer, Split, Lock, #4, SS	As applicable

Table 9-2. Illustrated Parts Breakdown		
Index Number	**Nomenclature**	**Replacement Procedure**
61	Washer, Flat, .566 x .255 x .030 Thk., SS	As applicable
62	Washer, Flat, #6, .032 Thk.	As applicable
63	Ring, Terminal	***Section 7.3.9.6***
64	Screw, 8-32 x 3/8, Hex Head, w/Washer	As applicable
65	Screw, 8-32 x 3/8, Flat Head, Phillips	As applicable
66	Screw, 10-32 x 1 7/8, Hex Head, w/Washer	As applicable
67	Screw, 10-32 x 1, Hex Head, w/Washer	As applicable
68	Screw, 4-40 x 3/16, Flat Head, Phillips	As applicable
69	Screw, 4-40 x 3/8, Pan Head, Phillips	As applicable
70	Screw, 4-40 x 3/8, Flat Head, Phillips	As applicable
71	Screw, 4-40 x 5/16, Hex Head, Slotted	As applicable
72	Screw, 4-24 x 3/8, Thread Cutting, Phillips	As applicable
73	Screw, 6-24 x 5/8, Pan Head, Phillips	As applicable
74	Screw, 6-32 x 1/4, Flat Head, Phillips	As applicable
75	Screw, 6-32 x 1/4, Pan Head, Phillips	As applicable
76	Screw, 6-32 x 1/2, Pan Head, Phillips	As applicable
77	Screw, 6-32 x 5/16, Hex Head, w/Washer	As applicable
78	Screw, 4-40 x 1/4, Hex Head, w/Washer	As applicable
79	Nut, M6, Hex, SS	***Section 7.3.9.6***
80	Nut, 6-32, KEP, w/Conical Washer	As applicable
81	Nut, 4-40, Hex, Cad/Zinc, Small Serrated	As applicable
82	Nut, M12, Hex	As applicable
83	Standoff, 4-40 x 1, M/F, Hex	***Section 7.3.9.4***
84	Wrap, Spiral	***Section 7.3.9.6***
85	Tie, Cable	***Section 7.3.9.6*** ***Section 7.3.9.9***

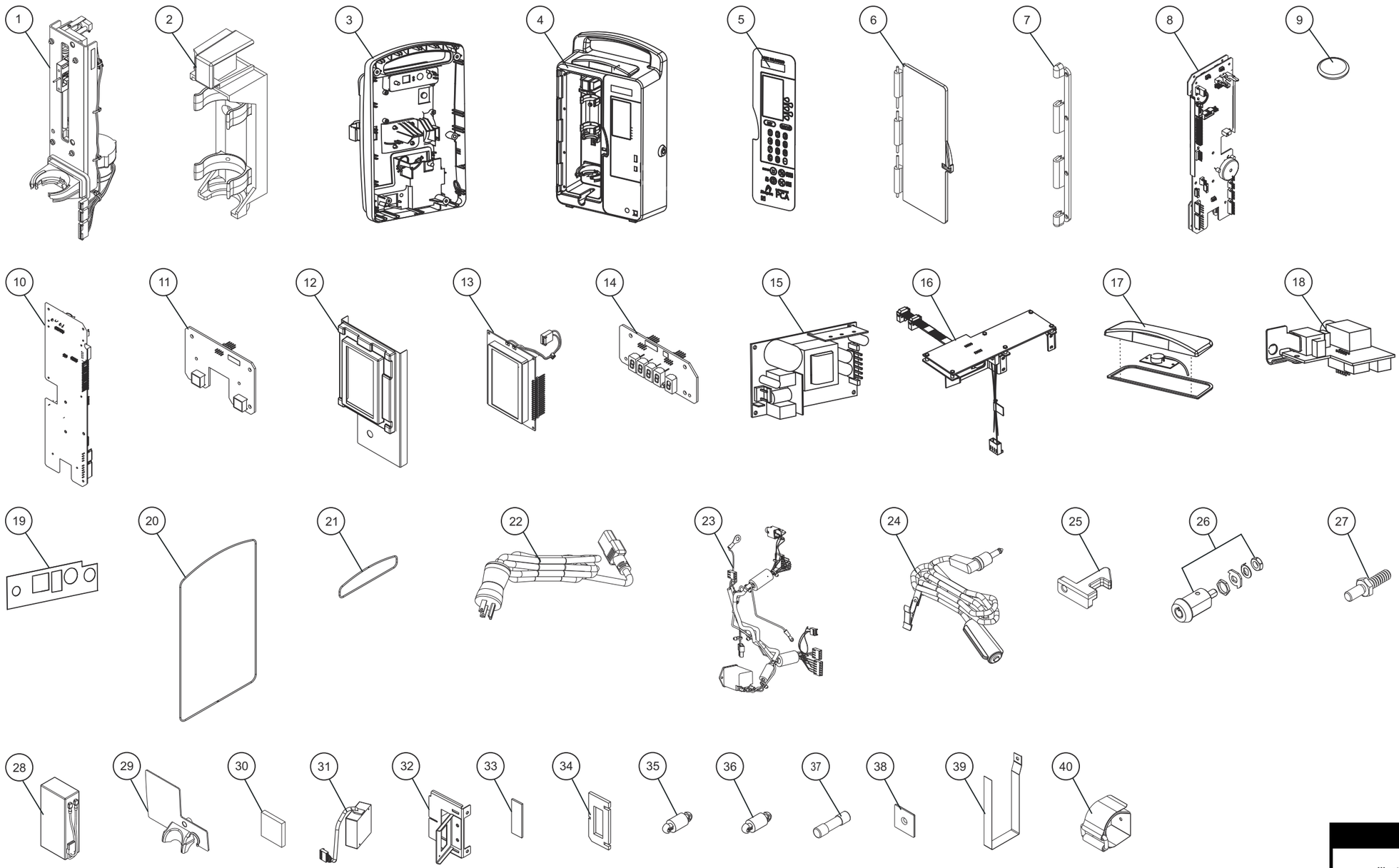

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Figure 9-1. Illustrated Parts Breakdown	
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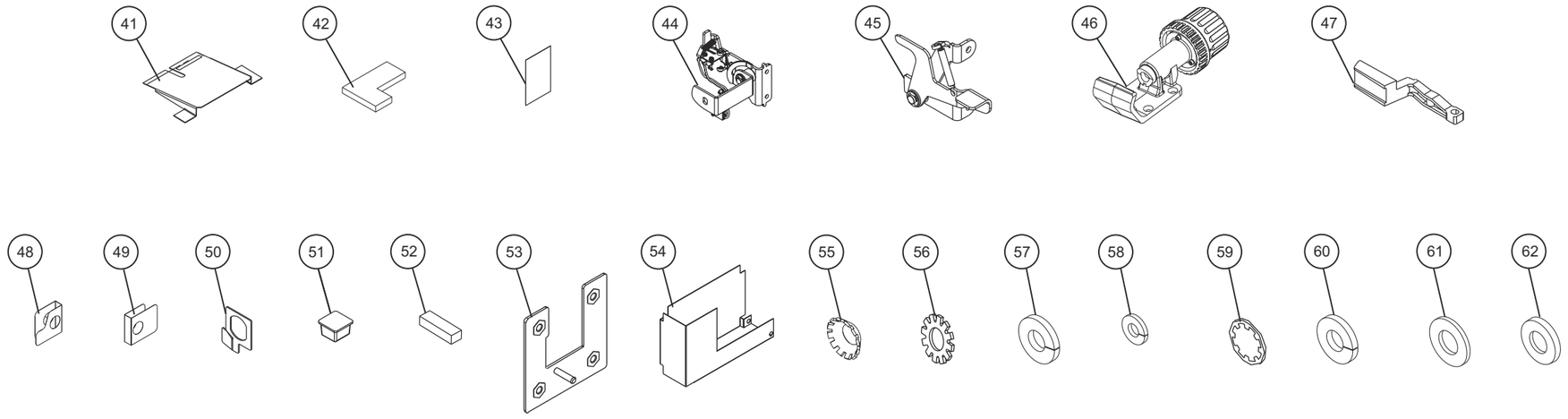

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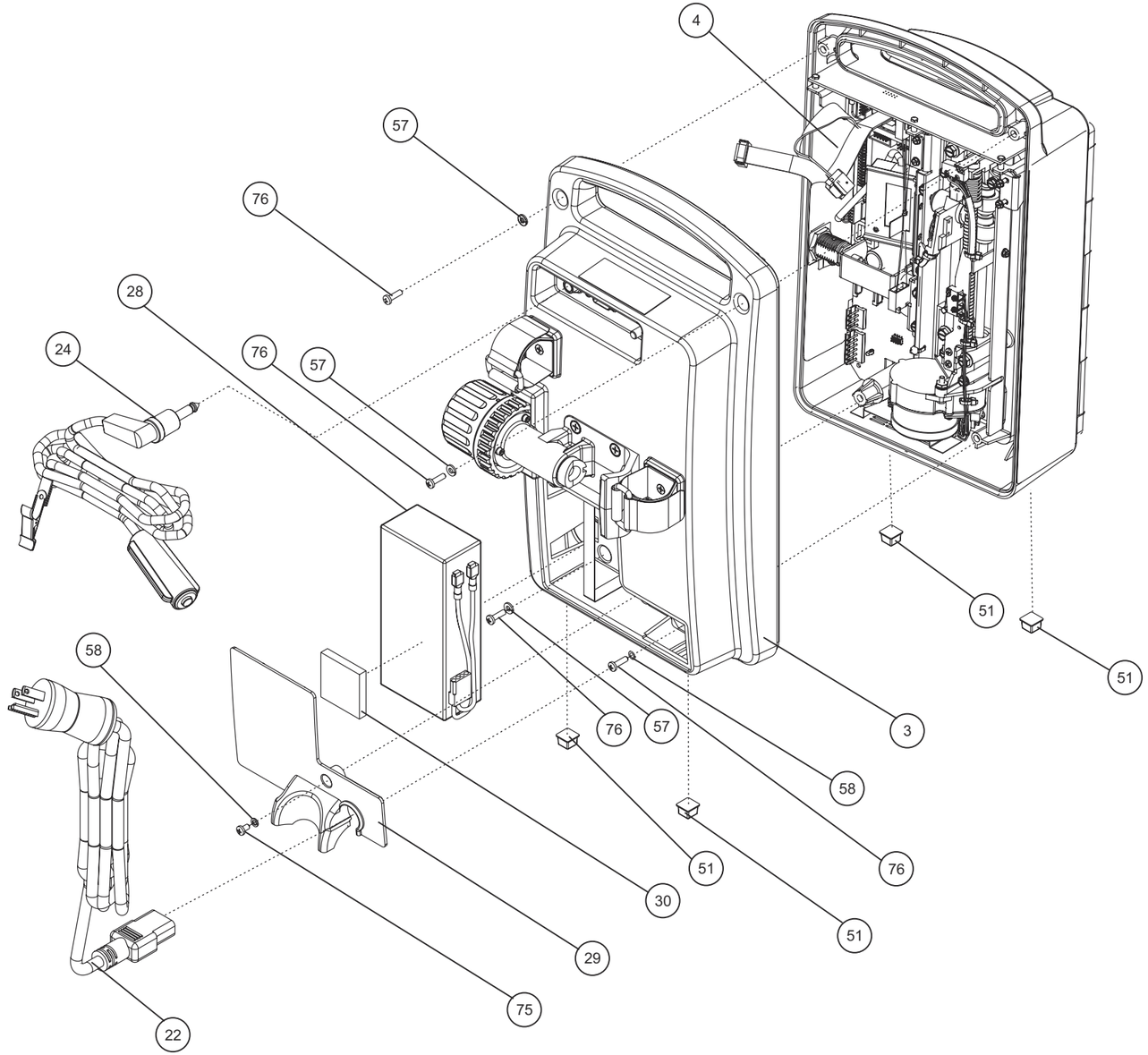

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Figure 9-2. Final Assembly	
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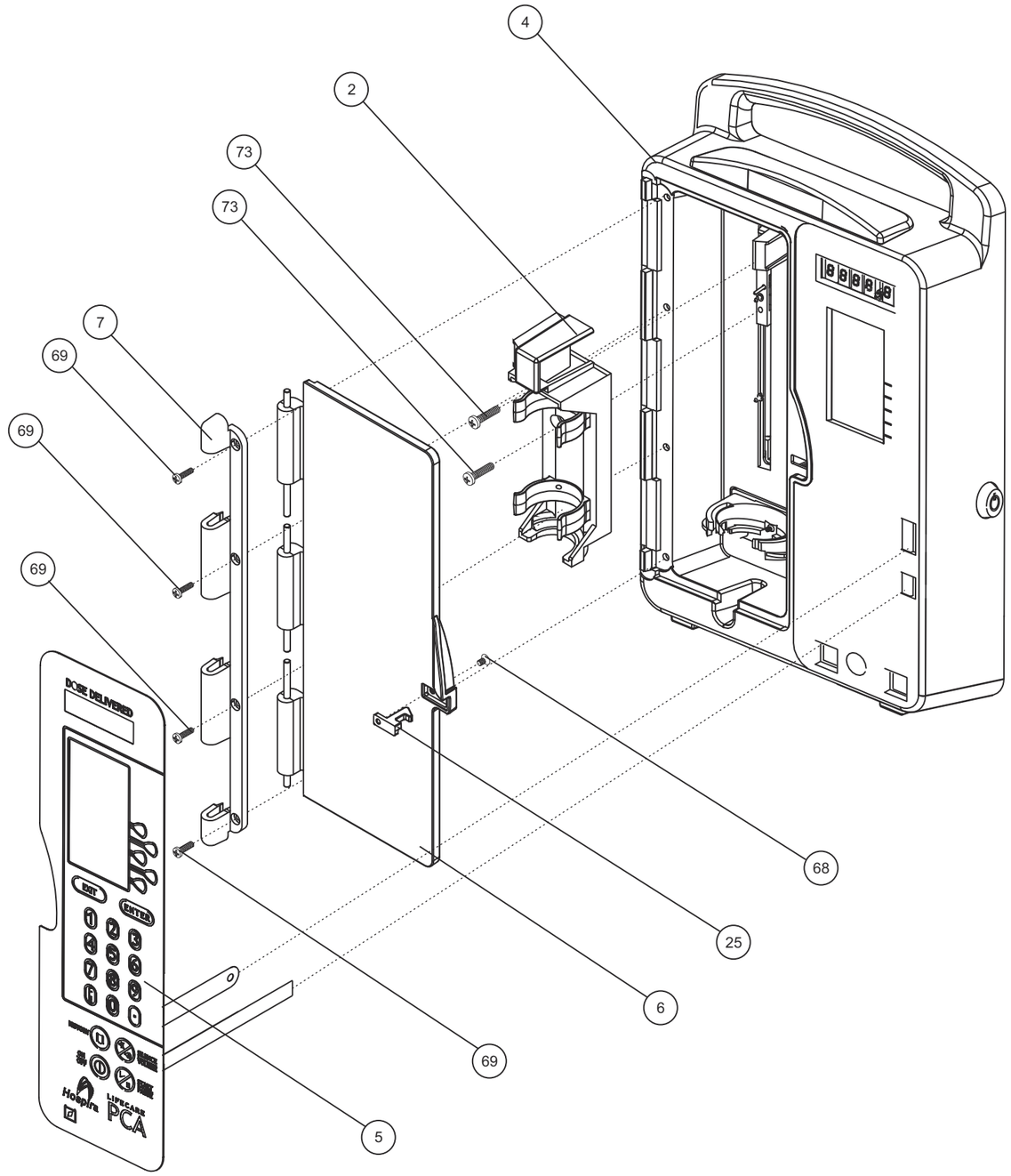

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Figure 9-3. Front Enclosure Assembly	
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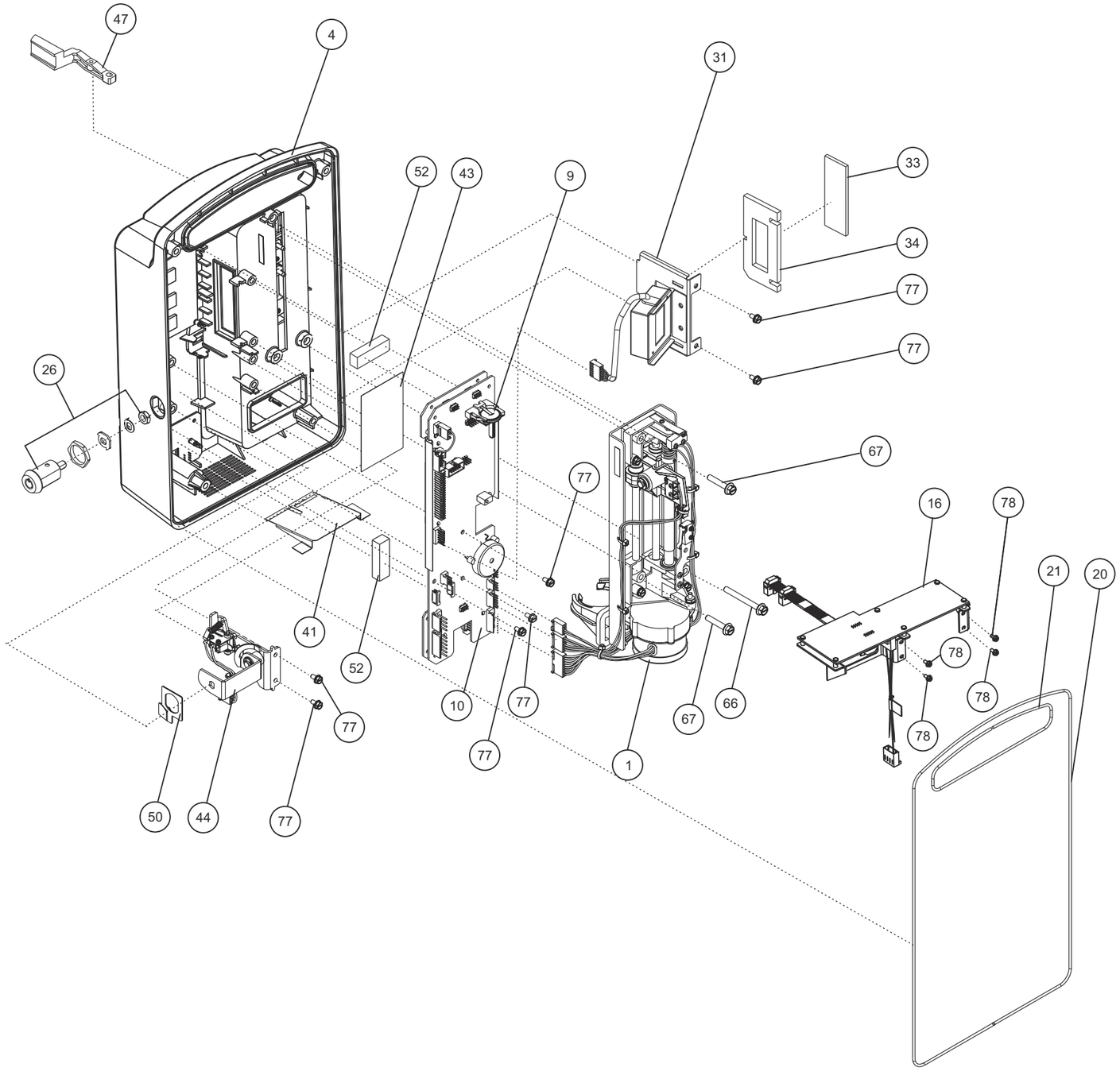

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Figure 9-3. Front Enclosure Assembly	
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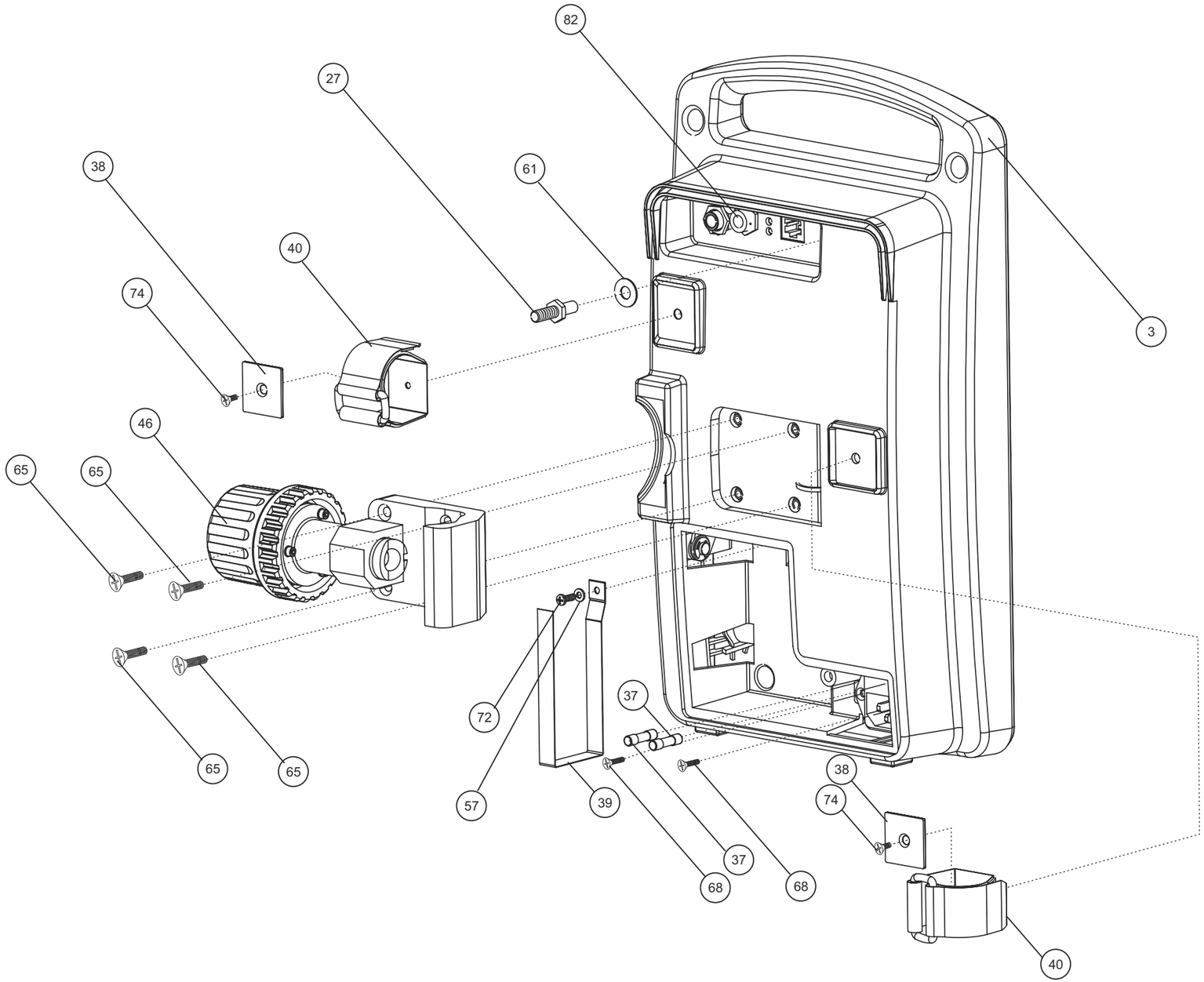

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Figure 9-4. Rear Enclosure Assembly	
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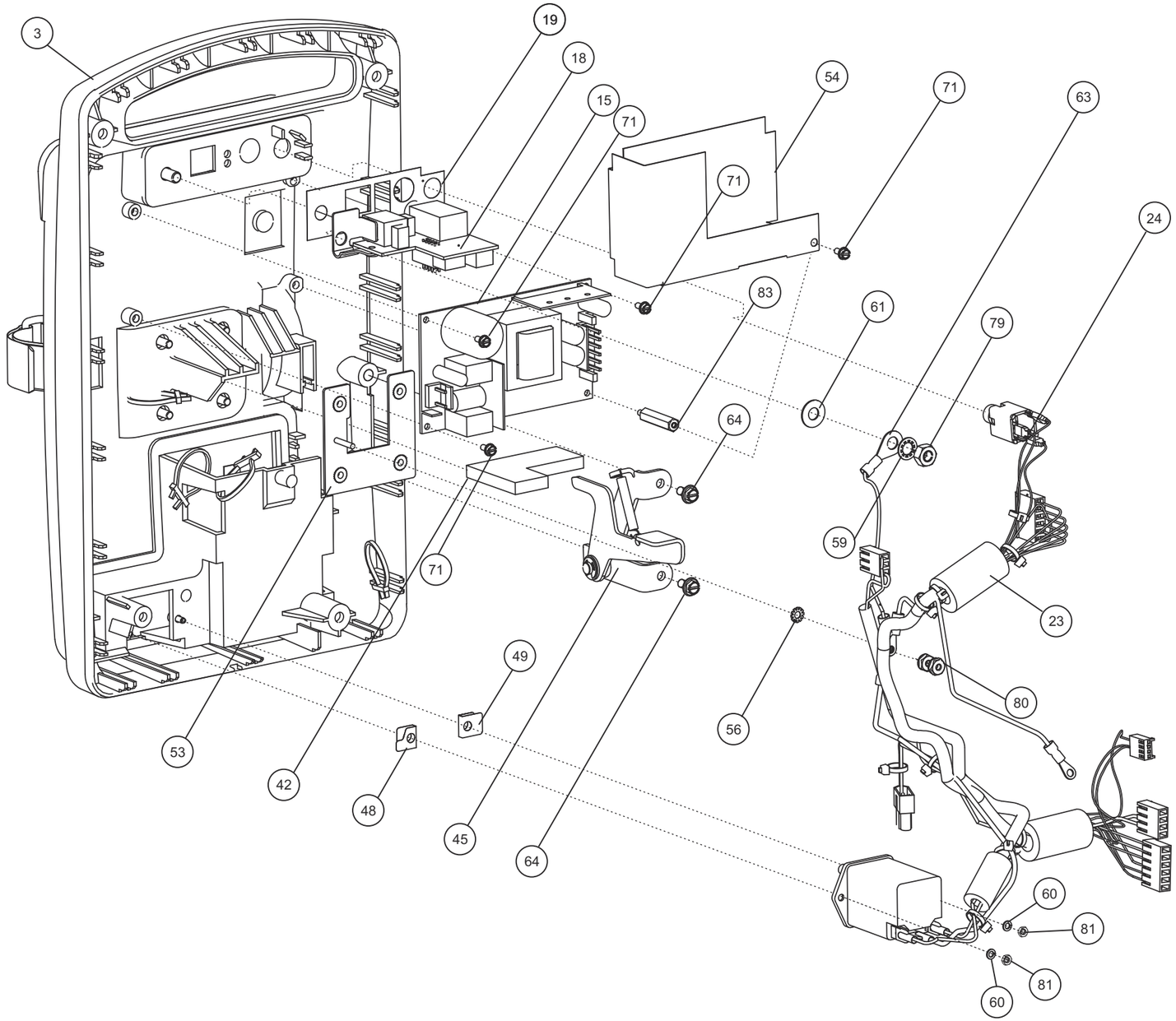

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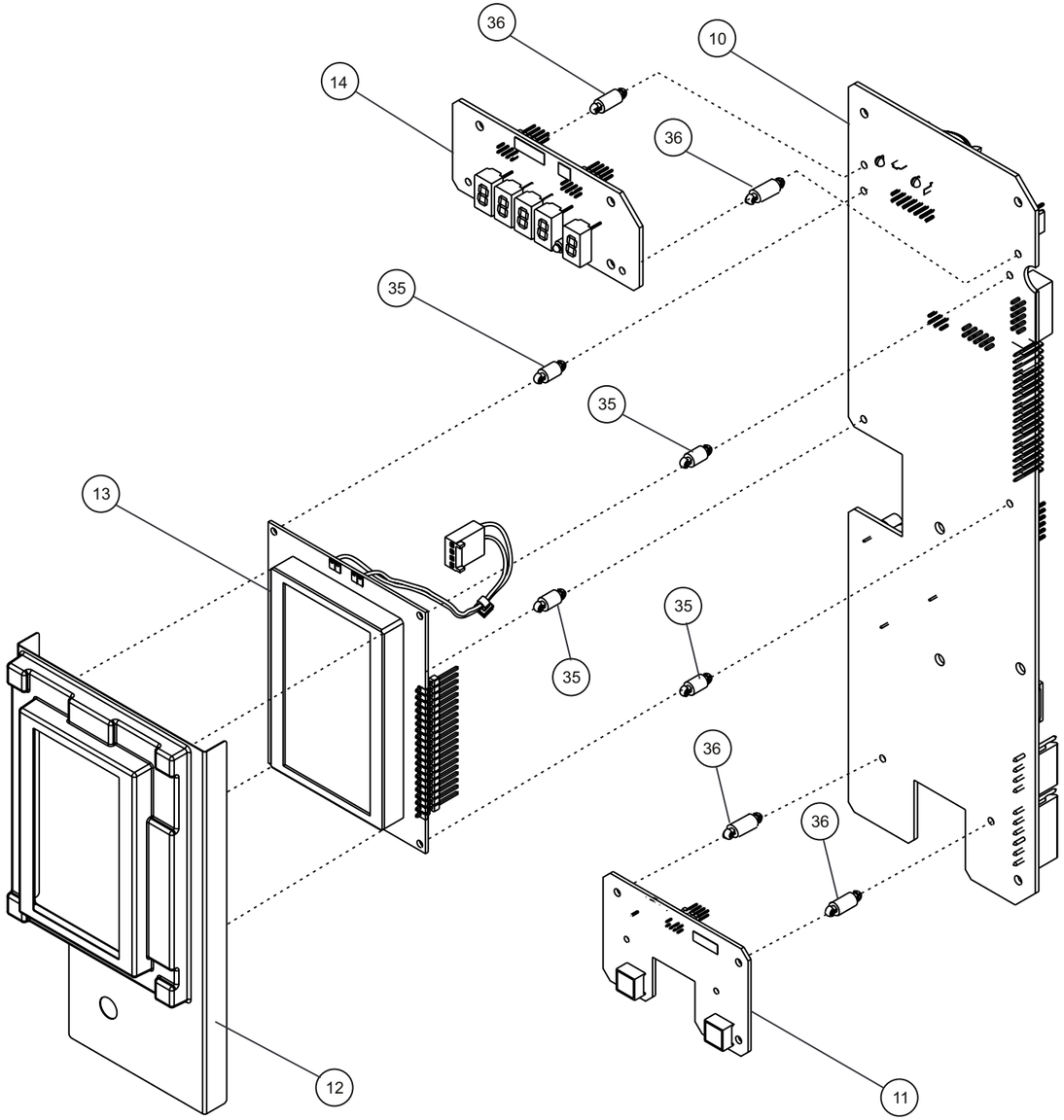

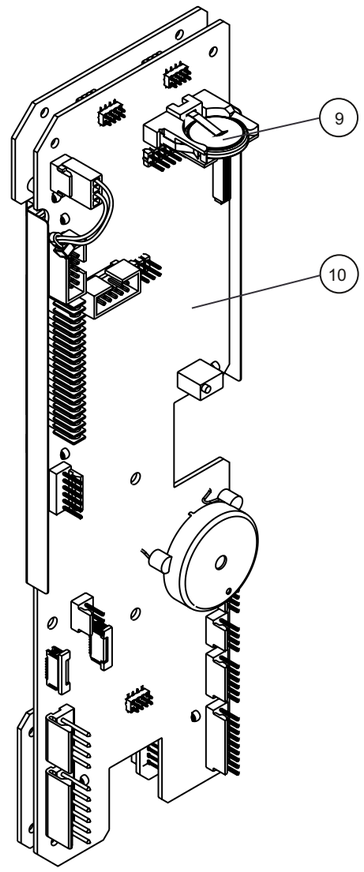

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Figure 9-5. Electronics Assembly	
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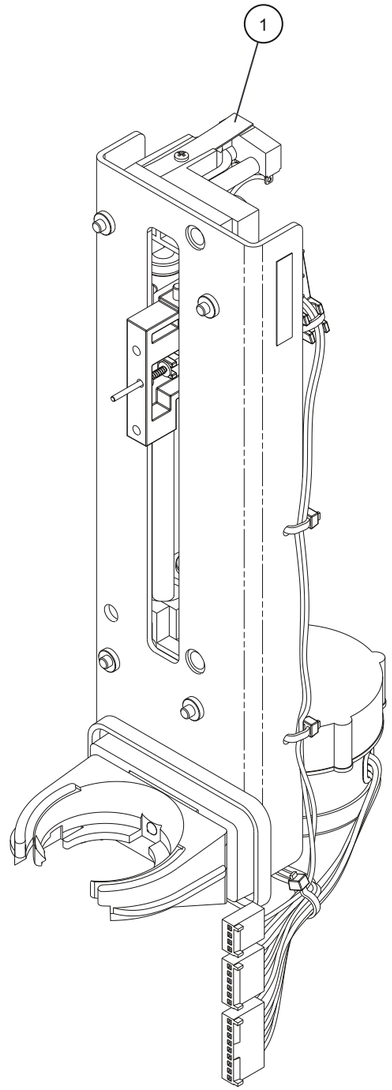

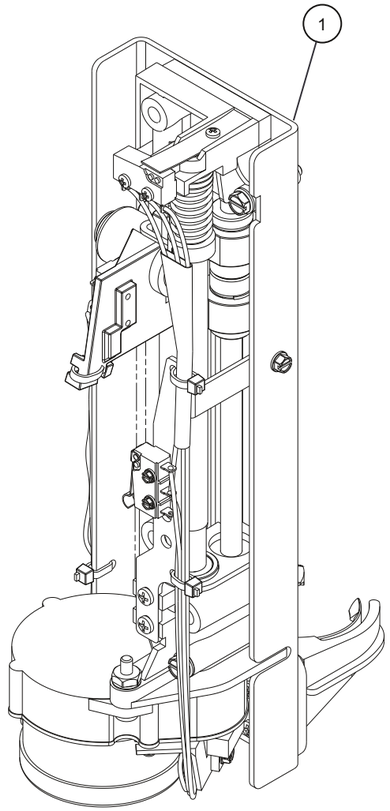

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Figure 9-6. Mechanism Assembly	
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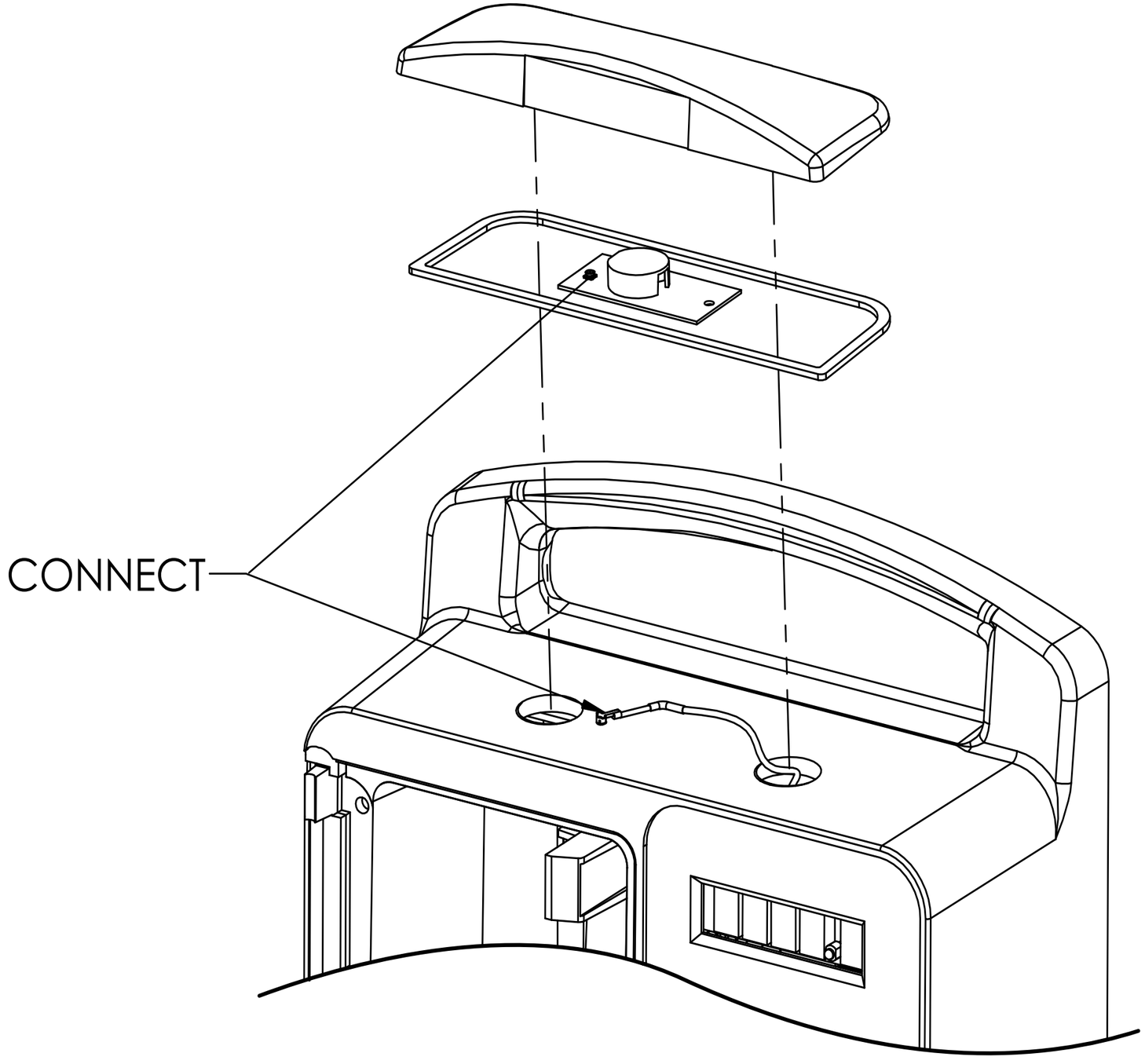

HOSPIRA, INC.	
Figure 9-7. Antenna Assembly	
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	Sheet 1 of 1

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APPENDIX

USE OF THE INFUSION SYSTEM IN ELECTROMAGNETIC ENVIRONMENTS

✓EN-2 The infusion system is intended for use in the electromagnetic environment specified in ***Table A-1***, ***Table A-2***, ***Table A-3***, and ***Table A-4***. The user of the infusion system should assure that it is used only in the appropriate environment.

ELECTROMAGNETIC EMISSIONS

Table A-1 details electromagnetic emissions compliance and guidance.

Table A-1.
Guidance and Manufacturer's Declaration - Electromagnetic Emissions

Emissions Test	Compliance	Electromagnetic Enforcement - Guidance
RF Emissions CISPR11	Class B	The infuser is suitable for use in all establishments, including domestic establishments and those directly connected to the public low voltage power supply network that supplies buildings used for domestic purposes
Harmonic Emissions IEC 61000-3-2	Class B	
Voltage Fluctuations/ Flicker Emissions IEC 61000-3-3	Complies	

ELECTROMAGNETIC IMMUNITY

Table A-2 details guidance for the electromagnetic environment.

Table A-2.
Guidance and Manufacturer's Declaration - Electromagnetic Immunity

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment Guidance
Electrostatic Discharge (ESD) IEC 61000-4-2	±6 kV Contact ±8 kV Air	±8 kV Contact ±15 kV Air	Floors should be wood, concrete, or ceramic tile If floors are covered with synthetic material, relative humidity should be at least 30%
Electrical Fast Transient/Burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	
Voltage Dips, Short Interruptions, and Voltage Variations on Power Supply Input Lines IEC 61000-4-11	<5% U_r (>95% dip in U_r) for 0.5 cycle 40% U_r (60% dip in U_r) for 5 cycles 70% U_r (30% dip in U_r) for 25 cycles 5% U_r (>95% dip in U_r) for 5 seconds	<5% U_r (>95% dip in U_r) for 0.5 cycle 40% U_r (60% dip in U_r) for 5 cycles 70% U_r (30% dip in U_r) for 25 cycles 5% U_r (>95% dip in U_r) for 5 seconds	Mains power quality should be that of a typical commercial or hospital environment If the user of the infusion system requires continued operation during power mains interruptions, it is recommended that the infuser be powered from an uninterruptible AC mains power supply or the battery
Power Frequency (50/60 Hz) Magnetic Field IEC 61000-4-8	3 A/m	400 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment

U_r is the AC Mains voltage prior to application of the test level.

Compliance levels are tested to IEC 60601-2-24 requirements, which are more stringent than IEC 61000-4-2 and IEC 61000-4-8.

ELECTROMAGNETIC IMMUNITY FOR LIFE-SUPPORTING EQUIPMENT AND SYSTEMS

Table A-3 provides guidance for use of the infusion system near communications equipment.

Table A-3.
Guidance and Manufacturer's Declaration -
Electromagnetic Immunity for Life-Supporting Equipment and Systems

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Immunity Guidance
Portable and mobile RF communications equipment should be used no closer to any part of the infusion system, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter			
Conducted RF IEC 61000-4-6	3 V_{rms} 150 kHz to 80 MHz outside ISM bands[a]	[V_1] V	Recommended separation distance $d = \left[\frac{3,5}{V_1}\right]\sqrt{P}$ $d = \left[\frac{12}{V_2}\right]\sqrt{P}$
	10 V_{rms} 150 kHz to 80 MHz in ISM bands[a]	[V_2] V	
Radiated RF IEC 61000-4-3	10 V/m 80 MHZ to 2.5 GHz	[E_1] V/m	Recommended separation distance: $d = \left[\frac{12}{E_1}\right]\sqrt{P}$ 80 MHz to 800 MHz $d = \left[\frac{23}{E_1}\right]\sqrt{P}$ 800 MHz to 2.5 GHz Where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in meters (m)[b] Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[c] should be less than the compliance level in each frequency range[d] Interference may occur in the vicinity of equipment marked with the following symbol

> **Note:** These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

At 80 MHz and 800 MHz, the higher frequency range applies.

a The industrial, scientific and medical (ISM) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.660 MHz to 40.700 MHz.

b The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz are intended to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges.

c Field strengths from fixed transmitters, such as base stations for radio (cellular and/or cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the infuser is used exceeds the applicable RF compliance level above, the infuser should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the infuser.

d Over the frequency range 150 kHz to 80 MHz, field strengths should be less than $[V_1]$ V/m.

RECOMMENDED SEPARATION DISTANCES FOR COMMUNICATIONS EQUIPMENT

The infusion system is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The recommendations provided in ***Table A-4*** help the user of the infusion system to prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the infuser, according to the maximum output power of the communications equipment.

Table A-4.
Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Infusion System

Rated Maximum Output Power of Transmitter (Watts)	Separation Distance According to Frequency of Transmitter (Meters)			
	150 kHz to 80 MHZ outside ISM bands $d = \left[\frac{3,5}{V_1}\right]\sqrt{P}$	150 kHz to 80 MHz in ISM bands $d = \left[\frac{12}{V_2}\right]\sqrt{P}$	80 Mhz to 800 MHz $d = \left[\frac{12}{E_1}\right]\sqrt{P}$	800 MHz to 2.5 GHz $d = \left[\frac{23}{E_1}\right]\sqrt{P}$
0.01	0.035	0.12	0.12	0.23
0.1	0.11	0.38	0.38	0.73
1	0.35	1.2	1.2	2.3
10	1.1	3.8	3.8	7.3
100	3.5	12	12	23
For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.				

> **Note:** These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structure, objects and people.

At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

The ISM bands between 150 kHz and 80 MHz are 6.765 MHz to 6.695 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.660 MHz to 40.700 MHz.

An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas.

V_1=10 V_{rms}, V_2=10 V_{rms}, and E_1=10 V/meter

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Type CF

Provides adequate degree of protection against electrical shock and suitable for application to patient

IPX1 Protected against dripping water

Class 1 Mains supply equipment using protective earth

✓EN-2 LifeCare PCA has been assessed and complies with IEC/EN 60601-1-2 (2001)

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